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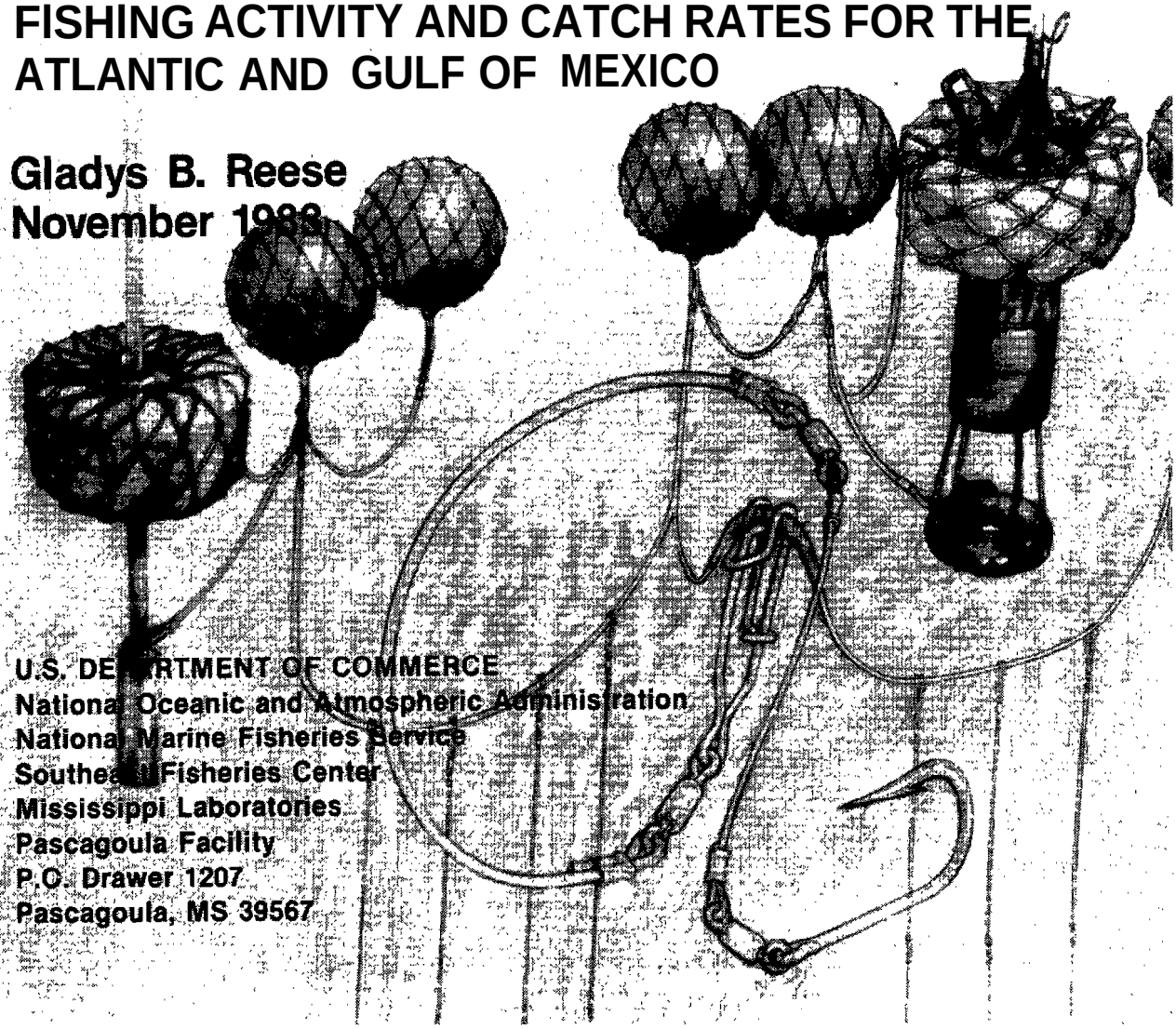
NMFS-SEFC-125

JAPANESE LONGLINE FISHING: COMPARISONS BETWEEN 1980 OBSERVER AND JAPANESE REPORT DATA AND BETWEEN 1979 AND 1980 FISHING ACTIVITY AND CATCH RATES FOR THE ATLANTIC AND GULF OF MEXICO

Gladys B. Reese

November 1983



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This publication is the second in a series of technical reports on the Japanese tuna longline fishery within the United States Fishery Conservation Zone (FCZ). The report compares southeast fisheries observer and Japanese Quarterly Statistical Report data for the tuna longline fishery in the Atlantic Ocean and the Gulf of Mexico during 1980. Additionally, comparisons of selected catch rates and harvests are made between 1979 and 1980.

KEYWORDS: *Fishing, *Fisheries, *Japan.

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U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
National Oceanic and Atmospheric Administration
John Byrne, Administrator
National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries

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SECTION I

INTRODUCTION

This publication is the second in a series of technical reports on the Japanese tuna longline fishery within the United States 'Fishery Conservation Zone (FCZ). The report compares southeast fisheries observer and Japanese Quarterly Statistical Report data for the tuna longline fishery in the Atlantic Ocean and the Gulf of Mexico during 1980. Additionally, comparisons of selected catch rates and harvests are made between 1979 and 1980.

1.1 BACKGROUND

The Magnuson Fisheries Conservation and Management Act (MFCMA) of 1976 established a Fishery Conservation Zone which is 200 nautical miles seaward from the baseline of the United States territorial sea [Figure 1). The Act authorizes exclusive United States management authority over all fish in the FCZ except the highly migratory species of tuna.

Although tuna are not managed under the MFCMA, the Japanese longline fishery does take other species (billfish, sharks and other finfish species) incidental to tuna fishing operations. The incidental species are subject to management; therefore, the tuna longline fishery must satisfy requirements of the MFCMA and Foreign Fishing Rules and Regulations when fishing within the Atlantic, Gulf and Caribbean FCZ.

Among requirements for permits to fish the FCZ is placement of observers aboard foreign vessels which are fishing for or incidentally catching any fish over which the United States has exclusive management authority. The owner or operator of each foreign fishing vessel to which an observer is

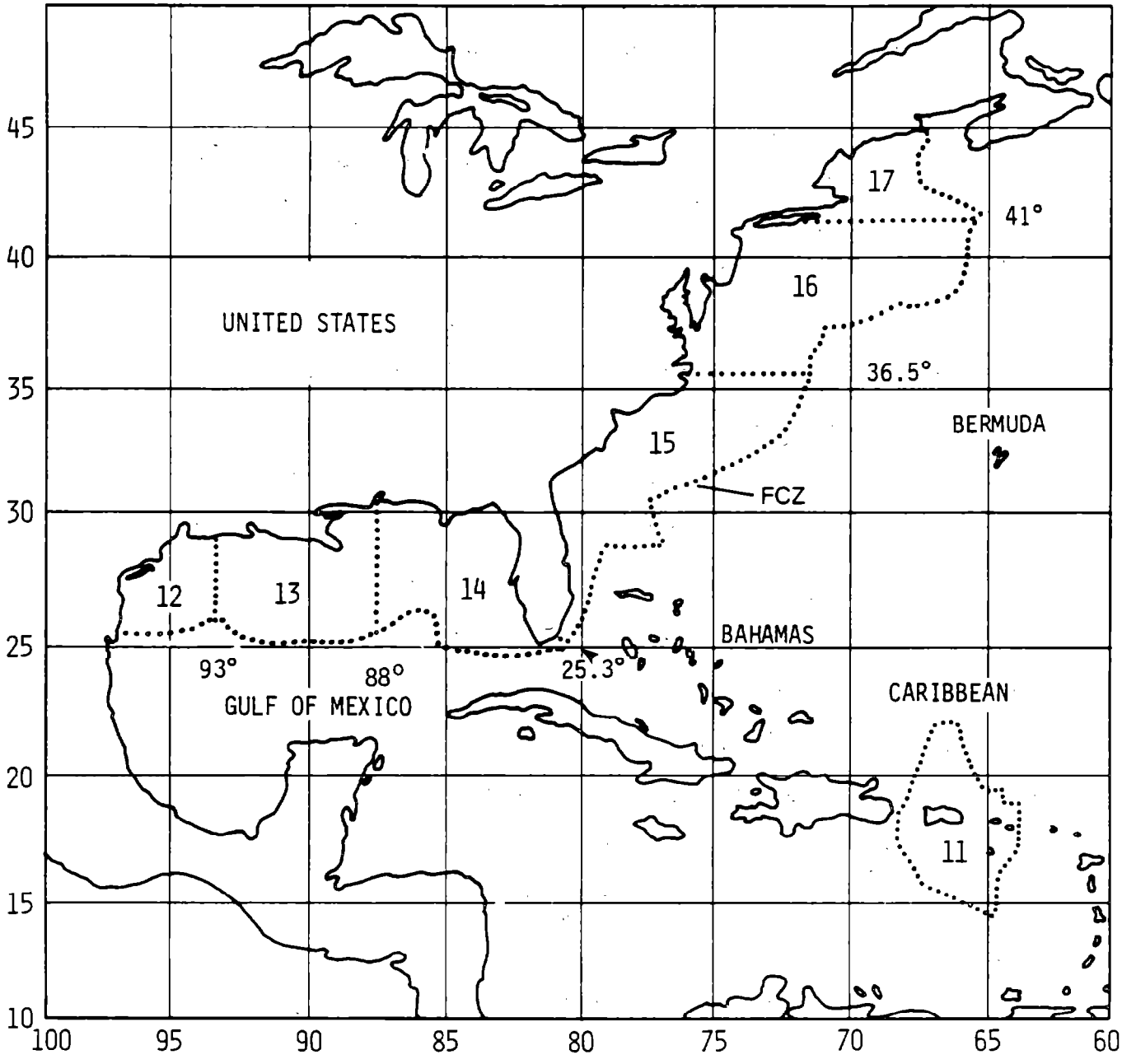


Figure 1. United States Fishery Conservation Zone (FCZ) divided into seven fishery zones.

assigned is required to reimburse the United States the cost of placing an observer aboard the vessel.

1.2 SOUTHEAST FISHERIES CENTER FOREIGN FISHERY OBSERVER PROJECT

Implementation of the MFCMA and the Preliminary Management Plan for Atlantic billfish and sharks established the need for observers to monitor billfish and sharks which are hooked incidentally by the Japanese longline fleet. In the Southeast Fisheries Center (SEFC) a Foreign Fishery Observer Project was organized to provide data for the management of the fishery. Responsibility for managing the project was assigned to the Mississippi Laboratories, Pascagoula Facility. The project has been in operation since March, 1978.

SEFC observer coverage normally would include only FCZ Zones 11 through 15; however, because the Japanese longline fishery operates from Zones 11 through 17, SEFC observer responsibilities were extended to include Zones 16 and 17 (Figure 1). This permitted continuous coverage of the Japanese tuna longline fishery.

Objectives of the SEFC Observer Project were to:

- Collect scientific data from foreign fishing vessels in the Atlantic, Gulf of Mexico and Caribbean FCZ;
- Monitor foreign fishing activities in the FCZ (for scientific purposes);
- Provide information on fishing and biological data on species caught; and
- Collect data for analysis of compliance by National Marine

Fisheries Services (NMFS) enforcement personnel.

1.3 PURPOSE OF REPORT

This 1980 statistical report has several purposes:

- o To evaluate the data provided by the Japanese in their required quarterly reports.
- o To describe reporting procedures and data collected.
- o To present summarized observer and Japanese quarterly report data for 1980.
- o To compare Observer data for 1979 and 1980 from the Atlantic and Gulf of Mexico.
- o To provide specific recommendations for future reporting requirements by the Japanese, and
- o To provide generalized recommendations concerning U.S. Coast Guard and NMFS monitoring and support needs.

SECTION 2.0

DATA SOURCES AND HANDLING

2.1 OBSERVER DATA

Observers collected catch and effort data on billfish, sharks, other prohibited species and the target species of tuna. Scientific data and information on gear setting operations, gear descriptions, haulback operations and environmental data for each longline set also were recorded (Appendix A). Upon return to Pascagoula, the data were checked for errors, keypunched, and verified for addition to the SEFC foreign fishing data management system (Thompson, 1982).

2.2 JAPANESE DATA

The Foreign Fishing Rules and Regulations (December 19, 1978) required foreign fishing vessels to report all harvested fish and incidental catches of marine mammals and endangered species. Vessels without an applicable allocation, such as the Japanese tuna longline fishery, are required to submit quarterly reports to the Director, SEFC, on any species taken incidental to tuna longline operations. The reports do not contain information on tuna. The reports contain catch and effort data summarized weekly by 1^{o} squares, and include number of hooks fished, number of sharks, billfish and other prohibited species caught, and the number of these species released dead or alive (Appendix B). A quarterly summary of vessel activities (Appendix C) also is required.

These summaries included permit number and noonday vessel locations of each vessel for each day spent in the FCZ during the reporting period. Data taken from these reports were checked for errors, keypunched and verified for addition to the SEFC regional foreign fishing data file.

The Foreign Fishing Rules and Regulations also require certain radio reports from foreign fishing vessels within the FCZ. Included in these reports are time and position the vessel began fishing, the time and position of any shift in fishing zones and the time and position when the vessel ceased fishing (i.e., leaves the FCZ). These messages are transmitted to the United States Coast Guard, entered into the Enforcement Management Information System (EMIS), and relayed to the observer project manager.

2.2.1 OBSERVERS SHIPBOARD DUTIES AND RESPONSIBILITIES

The primary responsibility of an observer while aboard a foreign fishing vessel was to collect scientific data (catch rates, catch composition and biological data) and biological specimens. Special emphasis was given to collection of catch and effort data on billfish, sharks and other prohibited species incidentally hooked by Japanese longline gear. Secondary responsibilities included the tagging of billfish and sharks, marine mammals and sea turtle observations, recording selected environmental data, and collection of data for compliance analysis by NMFS enforcement personnel. Normally, the observers were on duty and collected most of their information during haulback operations.

Longline gear is basically made up of a number of floats supporting a mainline below the water's surface. Attached to the mainline between the floats are gangions or hooks (Figure 2). Longline gear normally is set out around 0200 hours to 0700 hours in the Gulf of Mexico and around 0300 hours to 0700 hours in the Atlantic. Haulback of the gear in both the Gulf and Atlantic takes place from about 1100 hours to 2300 hours.

2.2.2 SCHEDULING OF VESSELS

The procedures used to place observers aboard Japanese longline vessels has been previously outlined in the 1979 Japanese Longline Fishing report (Thompson, 1982). Briefly, the scheduling of observers for duty aboard the foreign vessel begins with advance notice to the United States Coast Guard from the Federation of Japan Tuna Fisheries Co-operative Associations of their plans to begin fishing operations in the FCZ. The Coast Guard informs the observer project manager of the long-line vessel's scheduled entry. Deployments of observers are then coordi-nated between the project manager and the Federation's American agent (Sumar Shipping Company, New York, NY). Deployment schedules are communicated from the agent through the Tuna Federation to the affected vessels.

Vessel schedules normally required an observer to remain at-sea for approximately one month. While at sea, the observer would transfer to four or five vessels at weekly intervals to maximize coverage: Rota-tion schedules, however, could change due to weather conditions (too severe for transfer of observer), location of the next vessel, or be-cause a vessel is departing the FCZ.

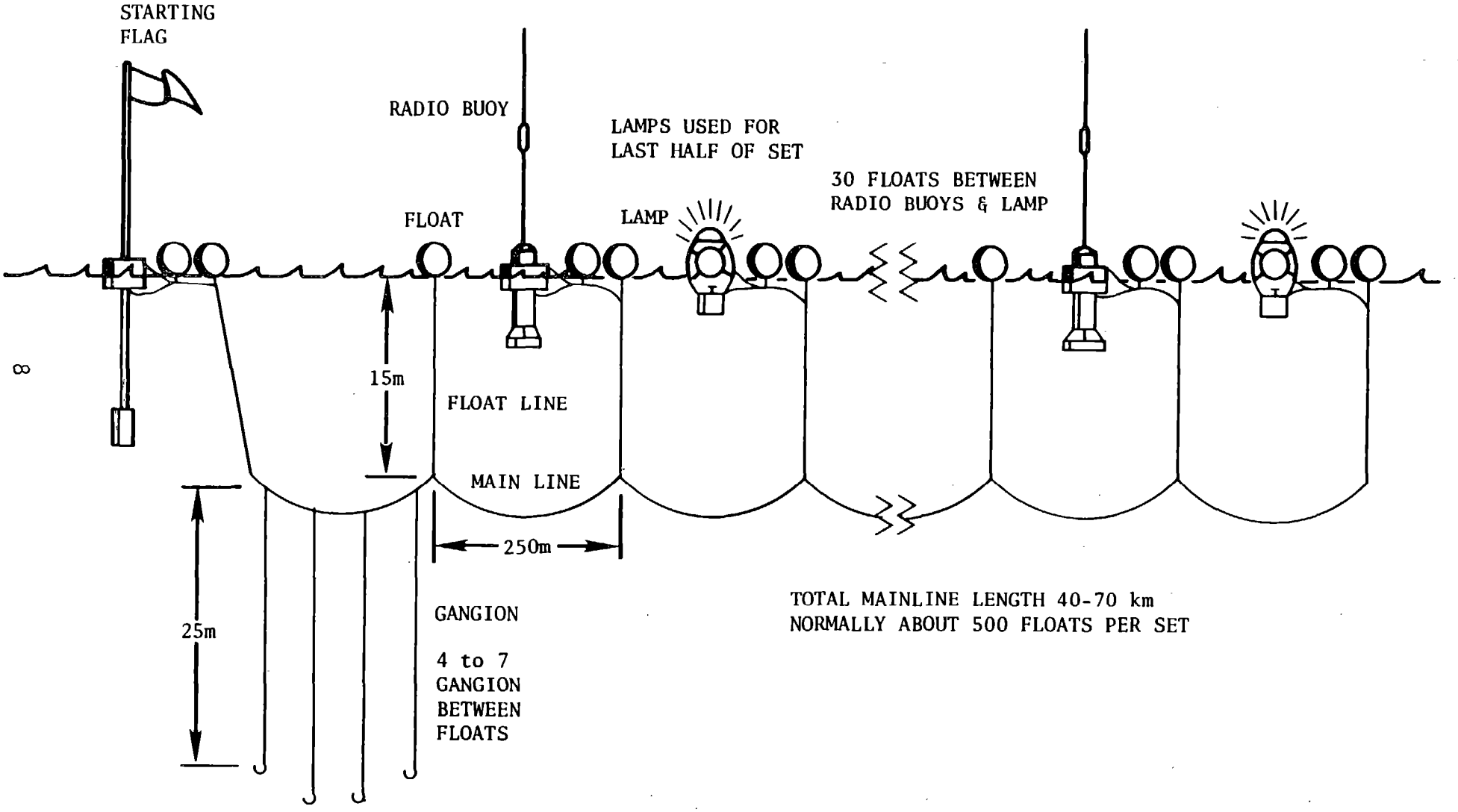


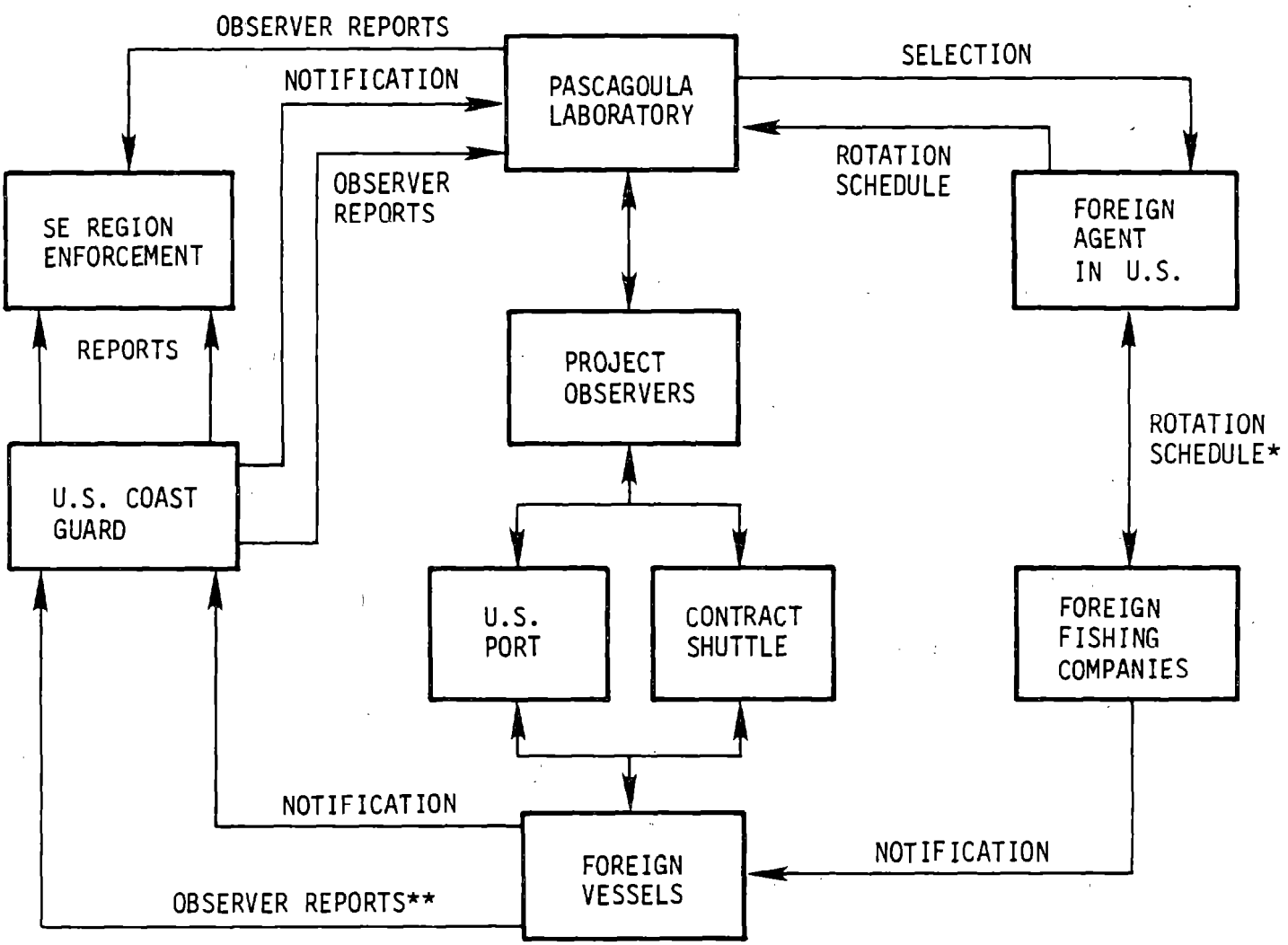
Figure 2. A typical Japanese longline set for tuna.

Observers boarded vessels at designated port locations or port entrance sea buoys. Observer return was accomplished in the same manner as deployment where the observers were brought to port or designated sea buoys upon completion of a cruise. Return schedules were arranged in advance with the shipping agency. Observer scheduling events are outlined in Figure 3.

2.2.3 VESSELS AND GEOGRAPHICAL COVERAGE

As reported in the 1979 Japanese Longline Fishing report (Thompson, 1982), a statistical test was performed to determine if observer coverage was biased toward the smaller vessels of the fishing fleet. The test compared mean vessel-ton-days in the FCZ for the entire fleet versus mean observer vessel-ton-days. Ton days were computed by multiplying the days a vessel spent in the FCZ by the gross weight of the vessel. Observer vessel-ton days were computed in a similar manner, by multiplying the gross weight of the vessel by the number of days observers were aboard the vessel. The 1979 test data indicated that observers were generally on the larger vessels (mean of 390.9 observer vessel-ton-days versus the fleet average of 382.7 vessel-ton-days.). Similar results were obtained when this test was performed on the 1980 data. The observers were placed on the larger vessels (mean of 358 observer vessel-ton days versus the fleet average of 355 vessel-ton days).

A second test was conducted in 1979 to determine if the vessels that exerted the most fishing pressure in the FCZ also received the



*NORMALLY NO MORE THAN ONE WEEK PER VESSEL AND FOUR CONSECUTIVE WEEKS PER OBSERVER IS SCHEDULED

**RADIO REPORTS SENT EVERY THREE DAYS

Figure 3. Scheduling events for placing observers on foreign vessels.

most observer coverage. The test was performed by regressing observer days on a vessel against the total number of days spent by the vessel in the FCZ. This test was again performed using 1980 observer data (Figure 4). Test results indicated observer coverage was somewhat better in 1980 than in 1979 (R^2= 0.729 versus R^2 = 0.532) indicating coverage was proportional to the amount of time a vessel spent in the FCZ.

The Japanese tuna longline fleet usually will concentrate fishing efforts in the Atlantic FCZ from June to January and the Gulf of Mexico from January to April following the change in distribution and availability of tuna. However, the longline fleet continued to fish the Atlantic FCZ throughout 1980, except during the month of March. Only minimal fishing effort was exerted from April to June and effort increased during July to December in the Atlantic.

The distribution of fishing effort by the longline fleet was determined by reviewing noonday vessel positions listed in the Japanese Quarterly Statistical Report (Appendix C) and observer coverage of the fleet. The review indicated the total geographic range of the fleet was adequately covered by observers (Figures 5 through 8). Minimal coverage was maintained in the Atlantic FCZ during the first quarter (January to March) due to logistical problems with the Japanese fleet in deploying observers.

Some observer coverage and Japanese fishing effort occurred outside the FCZ (Figures 5, through 8). Data from these sets were included, in the data evaluations.

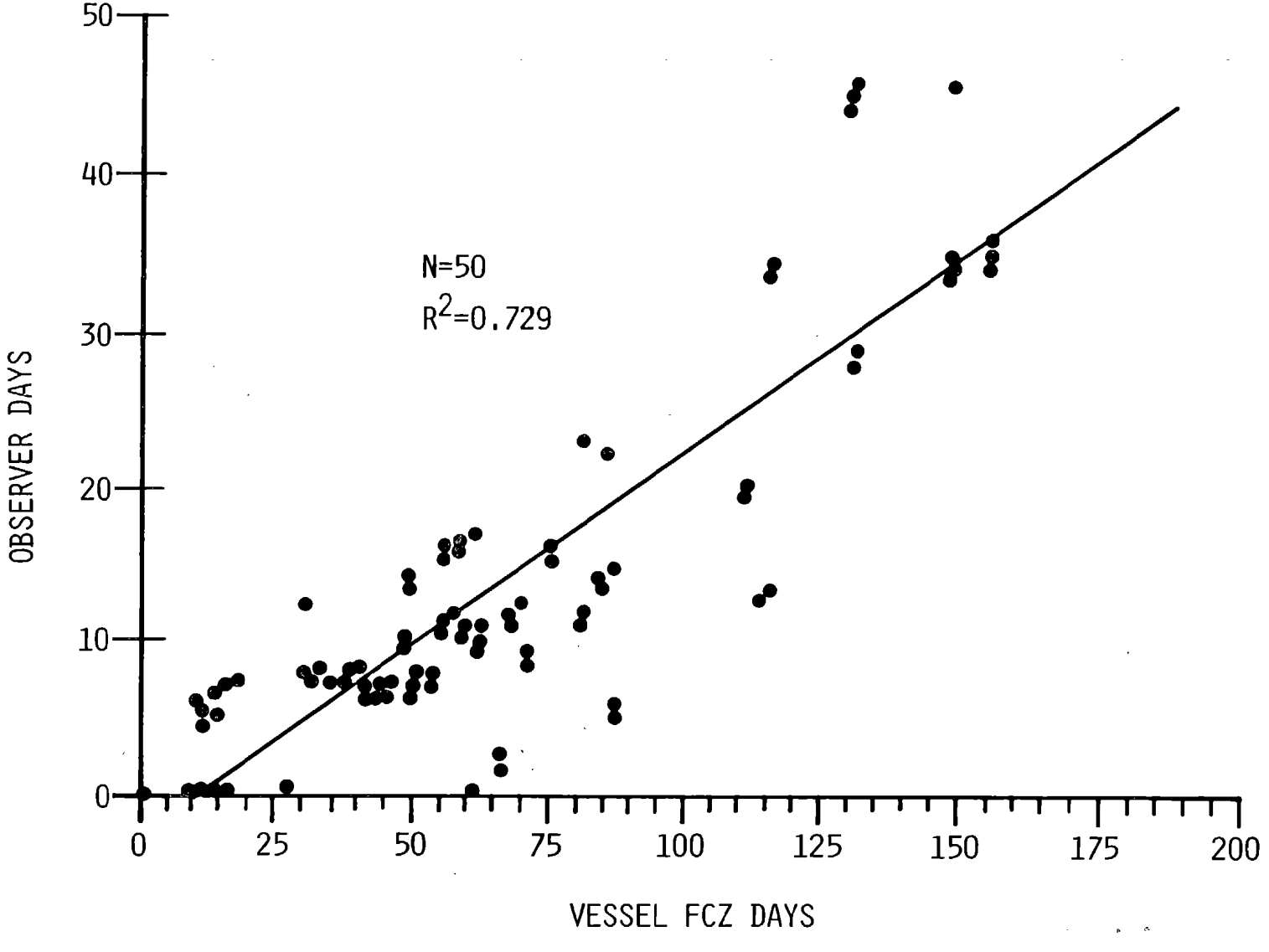


Figure 4. Relationship between observer coverage days and Japanese vessel days in FCZ.

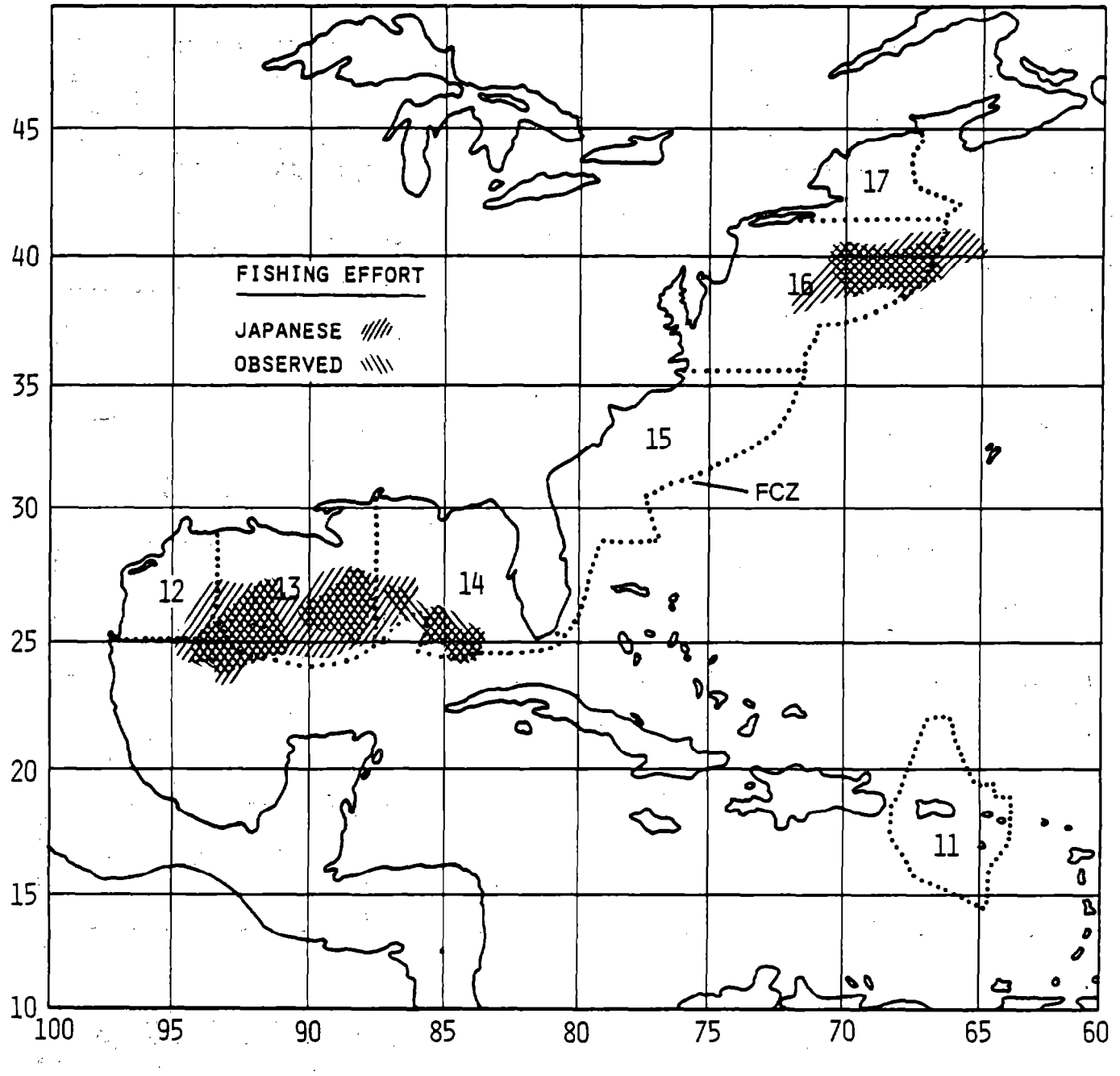


Figure 5. Japanese fishing effort and observer coverage for the first quarter, January to March, 1980.

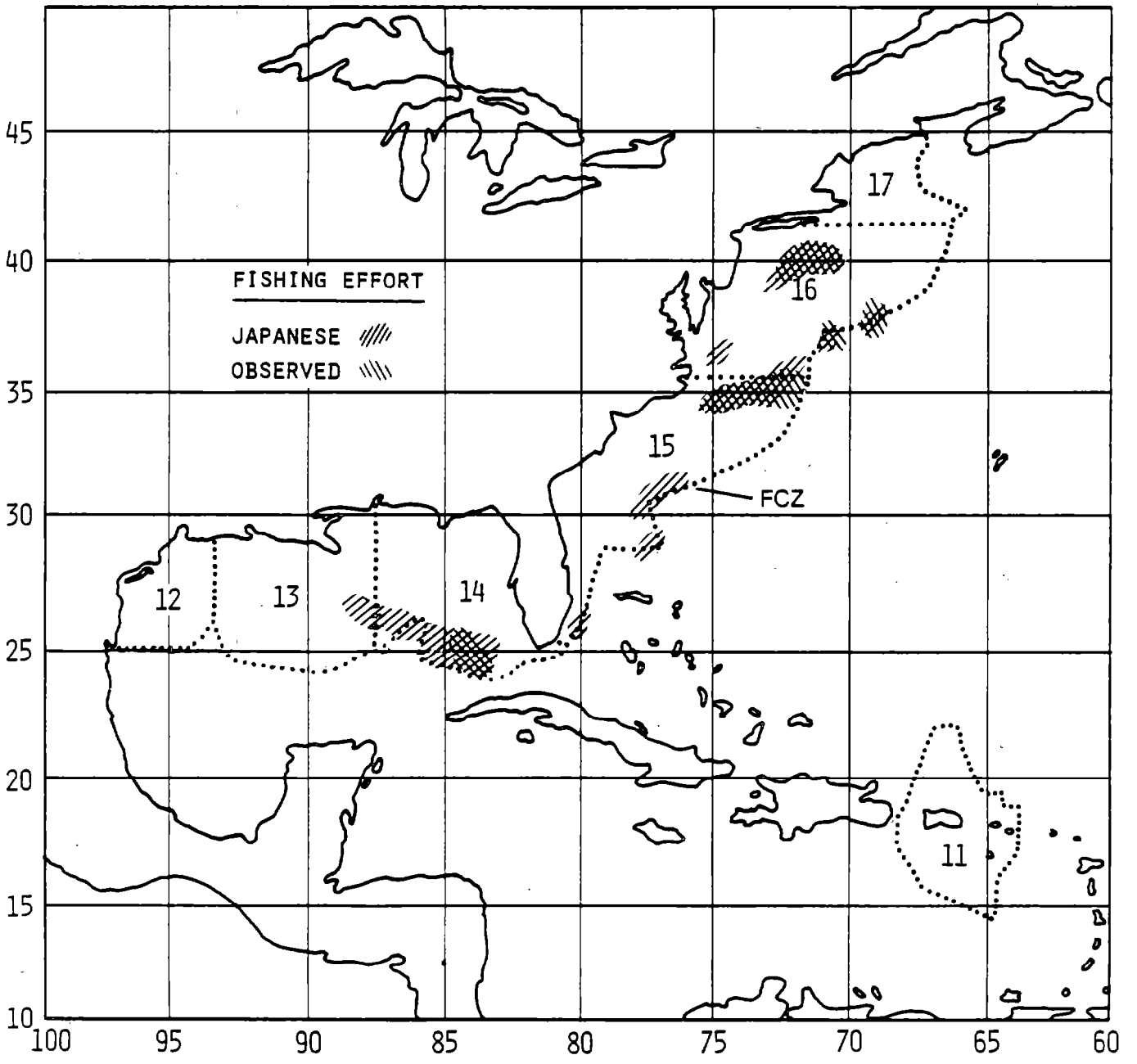


Figure 6. Japanese fishing effort and observer coverage for the second quarter, April to June, 1980.

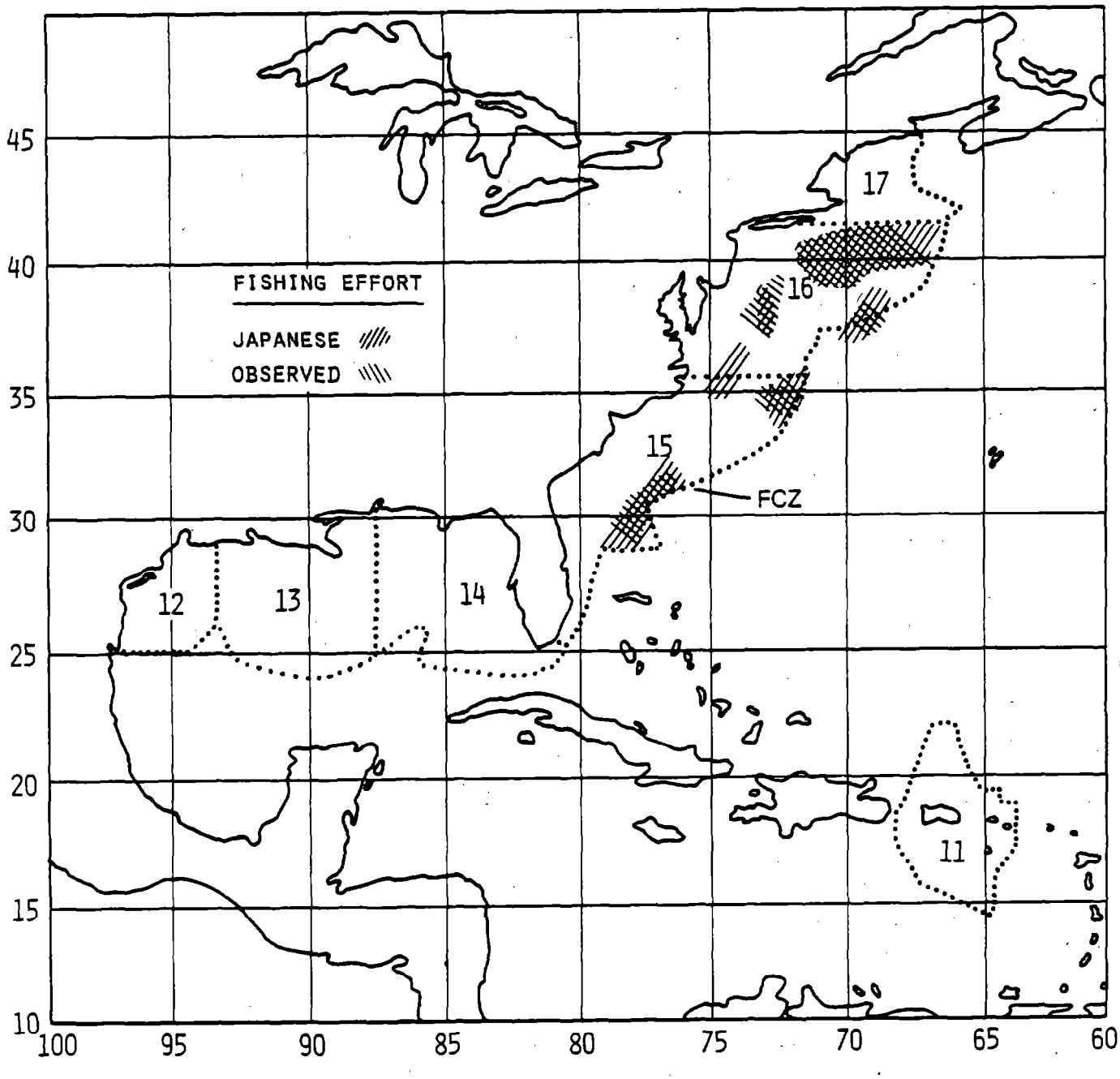


Figure 7. Japanese fishing effort and observer coverage for the third quarter, July to September, 1980.

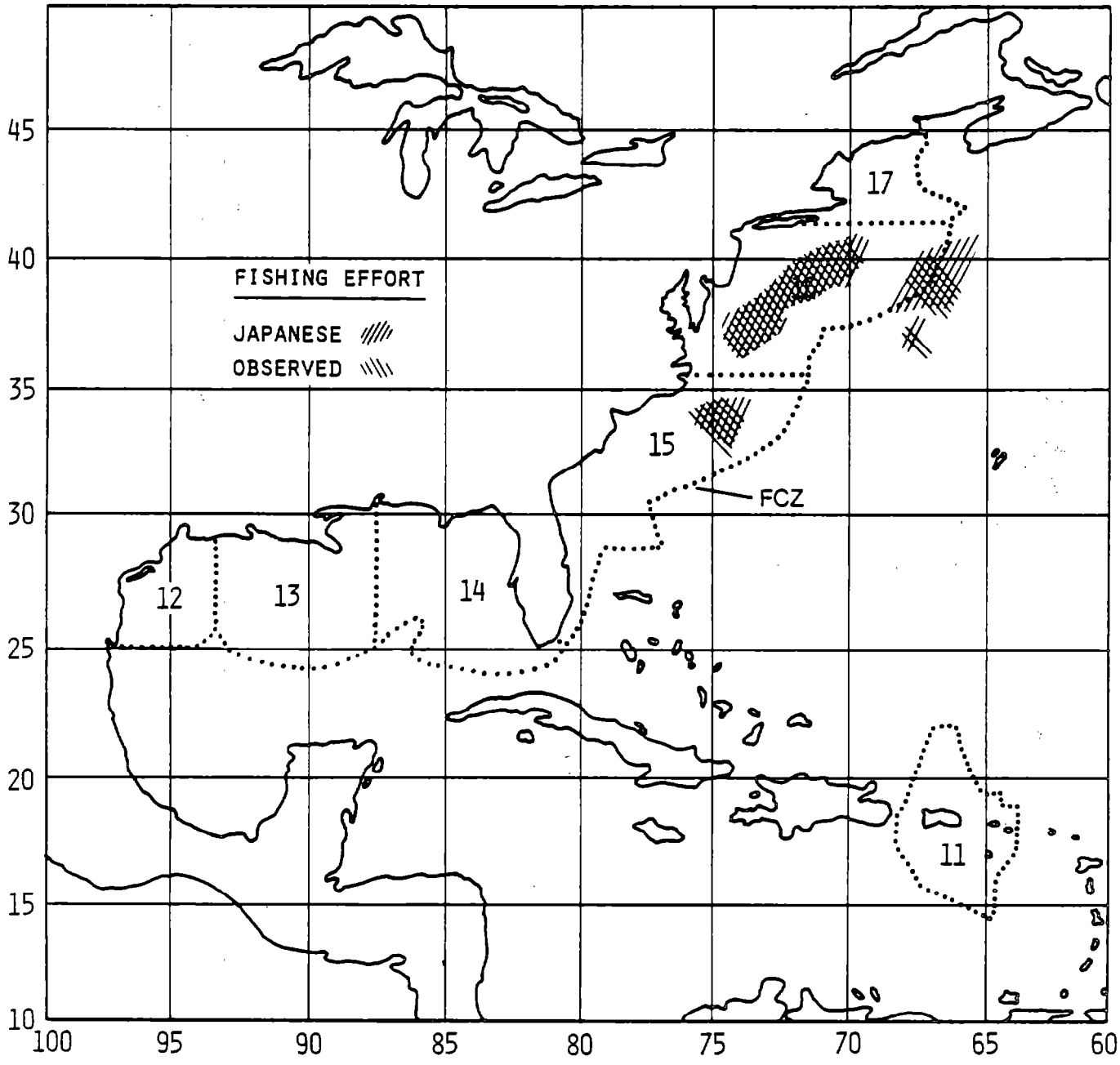


Figure 8. Japanese fishing effort and observer coverage for the fourth quarter, October to December, 1980.

SECTION 3.0

COMPARISON OF 1980 OBSERVER AND JAPANESE FISHING DATA

Procedures for evaluating the 1980 data were identical to those outlined in the 1979 Japanese Longline Fishing report (Thompson, 1982). Therefore, methods used in the 1980 report will be a recapitulation of those given in the aforementioned report. Methods used to evaluate comparisons between 1980 versus 1979 observer data also are explained.

3.1 FISHING EFFORT

A summary of Japanese vessel activity as reported to EMIS is shown in Table 1. Included in the summary is comparable information from noon-day positions for Japanese longline vessels as submitted in the Japanese Quarterly Statistical Reports,

Discrepancies between the two reports were noted throughout Table 1. Of the 50 vessels reporting, 29 (58%) were shown to have more total days reported in EMIS than were included on the Quarterly Statistical Reports; 14 (28%) showed more total days in the quarterly report than reported in EMIS; and only 6 (12%) showed the same number of days in both reports. One vessel, JA801222A, reported 25 days in the FCZ in the Quarterly Statistical Report, but none of these days were indicated in EMIS.

The EMIS report does not include days spent outside the FCZ. Therefore, it was felt that some of the discrepancies between the two reports might be reconciled by subtracting days outside the FCZ from each foreign vessel's total days. However, when this was done, only three more vessels

were found to be in agreement in both reports. Apparently, outside FCZ days have little effect on the discrepancies between the two reports.

The most obvious discrepancy in the two reports appears in the number of days each vessel spent in each fishing zone (Table 1). These differences vary from 0 to 33 days for an individual vessel. The maximum total days reported in a particular zone by EMIS for all vessels was 1,520 days for Zone 16. The Japanese Quarterly Statistical Report (noonday positions), however, indicated vessels spent 1,431 days in Zone 16, representing a difference of 89 days.

Fishing effort during 1980, based on EMIS derived information was 2,963 days as compared to 2,960 total days computed from noonday position reports. However, the total days computed from the Japanese noonday position reports include 203 vessel days outside the FCZ. If these outside days are subtracted from the total vessel days, the noonday position estimate reduces to 2,757 total vessel days compared to 2,963 vessel days from EMIS.

3.2 CATCH AND MORTALITY RATES

Annual and quarterly catches and catch rates from observer data and Japanese quarterly reports were summarized and presented in the same species format used in the Japanese quarterly reports (Tables 2-9). A statistical comparison of these two data sets, however, was not straightforward due to the way the Japanese data were reported. A modification of reporting requirements for the Japanese is needed to avoid continuation of this problem.

Table 1 - Comparison of Days Obtained from Japanese, Radio Reports, (EMIS) and Japanese Quarterly Report for 1980

Vessel Permit Number	Report	Total Days	Reported Days Outside FCZ	Zone 12	13	14	15	16	17
JA 80 1202 A	EMIS	69	0	0	32	37	0	0	0
	Japanese	72	7	0	24	40	1	0	0
JA 80 1208 A	EMIS	65	0	0	53	12	0	0	0
	Japanese	69	7	0	25	37	0	0	0
JA 80 1209 A	EMIS	46	0	0	0	46	0	0	0
	Japanese	52	6	0	5	41	0	0	0
JA 80 1210 A	EMIS	78	0	0	0	0	0	78	0
	Japanese	79	1	0	0	0	0	78	0
JA 80 1215 A	EMIS	40	0	0	0	0	0	40	0
	Japanese	39	0	0	0	0	0	39	0
JA 80 1219 A	EMIS	54	0	0	15	39	0	0	0
	Japanese	49	2	5	4	38	0	0	0
JA 80 1220 A	EMIS	16	0	0	0	0	0	16	0
	Japanese	16	1	0	0	0	0	15	0
JA 80 1222 A	EMIS	0	0	0	0	0	0	0	0
	Japanese	26	1	0	2	23	0	0	0
JA 80 1223 A	EMIS	59	0	0	23	36	0	0	0
	Japanese	59	6	3	12	38	0	0	0
JA 80 1225 A	EMIS	49	0	0	0	0	0	49	0
	Japanese	48	0	0	0	0	0	47	1
JA 80 1228 A	EMIS	86	0	0	0	26	8	52	0
	Japanese	83	2	0	0	24	7	50	0
JA 80 1231 A	EMIS	35	0	0	32	3	0	0	0
	Japanese	32	0	0	0	32	0	0	0

Table 1 (cont'd)

Vessel Permit Number	Report	Total Days	Reported Days Outside FCZ	Zone 12	13	14	15	16	17
JA 80 1234 A	EMIS	128	0	0	12	42	19	55	0
	Japanese	115	6	3	10	35	7	54	0
JA 80 1235 A	EMIS	163	0	0	0	32	3	128	0
	Japanese	148	0	0	2	29	22	95	0
JA 80 1238 A	EMIS	34	0	0	0	0	6	28	0
	Japanese	35	1	0	0	0	9	25	0
JA 80 1240 A	EMIS	135	0	0	8	27	26	74	0
	Japanese	133	10	1	5	28	19	70	0
JA 80 1241 A	EMIS	62	0	0	0	0	12	50	0
	Japanese	59	0	0	0	0	9	50	0
JA 80 1242 A	EMIS	145	0	0	0	0	42	103	0
	Japanese	141	17	0	0	0	54	70	0
JA 80 1244 A	EMIS	81	0	0	0	0	23	58	0
	Japanese	80	3	0	0	0	44	33	0
JA 80 1245 A	EMIS	213	0	0	9	55	65	84	0
	Japanese	170	29	0	5	24	57	55	0
JA 80 1248 A	EMIS	43	0	0	0	0	27	16	0
	Japanese	42	15	0	0	0	20	7	0
JA 80 1249 A	EMIS	104	0	0	7	55	4	38	0
	Japanese	139	15	0	9	53	24	38	0
JA 80 1251 A	EMIS	10	0	0	0	0	0	10	0
	Japanese	12	5	0	0	0	0	7	0
JA 80 1255 A	EMIS	129	0	0	0	0	3	126	0
	Japanese	112	2	0	0	0	1	109	0

Table 1 (cont'd)

Vessel Permit Number	Report	Total Days	Reported Days Outside FCZ	Zone 12	13	14	15	16	17
JA 80 1256 A	EMIS	66	0	0	11	43	5	7	0
	Japanese	52	1	0	11	40	0	0	0
JA 80 1263 A	EMIS	63	0	0	0	0	0	63	0
	Japanese	69	1	0	0	0	0	68	0
JA 80 1267 A	EMIS	54	0	0	22	32	0	0	0
	Japanese	51	1	1	5	44	0	0	0
JA 80 1269 A	EMIS	70	0	0	0	16	0	53	1
	Japanese	85	1	0	0	14	0	68	2
JA 80 1277 A	EMIS	99	0	0	0	0	0	99	0
	Japanese	106	0	0	0	0	0	106	0
JA 80 1281 A	EMIS	8	0	0	0	0	0	8	0
	Japanese	22	13	0	0	0	0	9	0
JA 80 1311 A	EMIS	37	0	0	0	37	0	0	0
	Japanese	36	0	0	3	33	0	0	0
JA 80 1314 A	EMIS	65	0	0	22	43	0	0	0
	Japanese	59	11	3	6	39	0	0	0
JA 80 1334 A	EMIS	31	0	0	0	31	0	0	0
	Japanese	30	1	0	2	27	0	0	0
JA 80 1339 A	EMIS	69	0	0	22	47	0	0	0
	Japanese	56	10	0	13	33	0	0	0
JA 80 1353 A	EMIS	67	0	0	57	10	0	0	0
	Japanese	65	9	0	22	34	0	0	0
JA 80 1354 A	EMIS	68	0	25	1	42	0	0	0
	Japanese	68	11	5	16	36	0	0	0

Table 1 (cont'd)

Vessel Permit Number	Report	Total Days	Reported Days Outside FCZ	Zone 12	13	14	15	16	17
JA 80 1357 A	EMIS	100	0	0	0	42	50	8	0
	Japanese	96	7	0	0	41	22	26	0
JA 80 1359 A	EMIS	12	0	0	12	0	0	0	0
	Japanese	12	0	0	2	10	0	0	0
JA 80 1360 A	EMIS	45	0	0	0	0	15	30	0
	Japanese	42	0	0	0	0	13	29	0
JA 80 1370 A	EMIS	14	0	0	0	0	0	14	0
	Japanese	11	0	0	0	0	0	11	0
JA 80 1371 A	EMIS	1	0	0	0	0	0	1	0
	Japanese	1	0	0	0	0	0	1	0
JA 80 1372 A	EMIS	12	0	0	0	0	0	12	0
	Japanese	11	0	0	0	0	0	11	0
JA 80 1373 A	EMIS	61	0	0	0	0	0	61	0
	Japanese	57	0	0	0	0	0	57	0
JA 80 1377 A	EMIS	13	0	0	0	0	0	13	0
	Japanese	10	0	0	0	0	0	10	0
JA 80 1379 A	EMIS	14	0	0	0	0	0	14	0
	Japanese	14	0	0	0	0	0	14	0
JA 80 1388 A	EMIS	74	0	0	0	0	0	74	0
	Japanese	72	0	0	0	0	0	72	0
JA 80 1391 A	EMIS	14	0	0	0	0	0	14	0
	Japanese	44	0	0	0	0	0	44	0

Table 1 (cont'd)

Vessel Permit Number	Report	Total Days	Reported Days Outside FCZ	Zone 12	13	14	15	16	17
JA 80 1392 A	EMIS	3	0	0	0	0	0	3	0
	Japanese	11	1	0	0	0	0	10	0
JA 80 1397 A	EMIS	28	0	0	0	0	0	28	0
	Japanese	57	0	0	0	0	17	40	0
JA 80 1398 A	EMIS	31	0	0	0	0	18	13	0
	Japanese	13	0	0	0	0	0	13	0
TOTALS	EMIS	2963	0	25	338	753	326	1520	1
	Japanese	2960	203	21	183	793	326	1431	3

Catch rates for observer data were computed by dividing the number of fish of a given species caught during a set by the number of hooks in the set. The quotient was multiplied by 100 to express catch by hundred hooks as:

$$x_{ij} = \frac{Fij}{Hj} \times 100 \qquad (1)$$

where Fij = number of i-th species caught during the j-th set, and

Hj = number of hooks in the j-th set.

Catch rates from the Japanese quarterly reports were computed by dividing the total number of a given species caught in a quarterly or annual time period by the total number of hooks reported during the same period. The quotient was multiplied by 100 to express catch rate on a hundred hook basis. The computation provided quarterly and annual catch rates which, if accurately reported by the Japanese, should represent population means (m).

Population variances for the Japanese data were not computed due to confounding, a problem which should be corrected. Confounding was caused by the reporting procedure which required the Japanese to summarize catch data by 1^{o} squares and 7-day periods. Thus, instead of a report entry representing a single set from which useful catch statistics could be computed, it represented anywhere from one to seven or more sets. While this type of reporting requirement probably does not significantly

affect mean quarterly or annual catch rates, it essentially eliminates any possibility of deriving useful measures of population variances.

The Japanese-reported catch rates were evaluated quarterly and annually by comparison with observer-derived catch rates. This evaluation was done by a t-test as:

$$t_i = \frac{(\bar{x}_i - \mu_i)\sqrt{n}}{s_i} \qquad (2)$$

where: $\bar{x}_i$ = mean catch rate for i-th species from observer data,

$$\bar{x}_i = \sum_{j=1}^{n} x_{ij}/n$$

μ_i = population catch rate for i-th species from Japanese data (assumes no reporting errors),

n = number of observer sets, and

S_1 = standard deviation of observer reported catch rates for i-th species.

The mortality associated with prohibited species reported by observers was computed as:

$$Po_i = \frac{D_i}{T_i} \qquad (3)$$

where: D_i = number of species of i reported dead, and

T_i = number dead + number alive of species i.

Total catch of a prohibited species was not used in the denominator because the observers were instructed not to guess if there was any question about the condition of a given animal. This resulted in a relatively small, but nevertheless significant, number of "unknowns"

being reported which were excluded from the mortality computations. The Japanese, on the other hand, reported all captures as either dead or alive, without a category for "unknown". Thus, mortalities for the Japanese-reported catches of a given species were computed by dividing the number dead by the' total number caught.

Capture mortalities reported by the Japanese were evaluated based on those derived from the observer data according to a technique described by Sokal and Rohlf (1969).

This technique relies on a t-test as:

$$t = \frac{\text{arcsine}\sqrt{Po_i} - \text{arcsine}\sqrt{Pj_i}}{\sqrt{820.8\,(1/To_i + 1/Tj_i)}} \qquad (4)$$

where: Po_i = dead proportion of, species i reported by observers

Pj_i = dead proportion of species i reported by Japanese

To_i = number dead + number alive of species i reported by observers

Tj_i = number dead + number alive of species i reported by Japanese, and

820.8 = constant representing the parametric variance of a distribution of aresine transformation of proportions.

3.2.1 ATLANTIC

Quarterly catch rates (mean catch/l00 hooks) and mortality rates (% dead) from observer data and Japanese Quarterly Statistical Reports were compared for significant differences between catch and mortality rates for the Atlantic (Tables 2-5).

First quarter comparisons are shown in Table 2. Comparisons were not made for blue marlin, white marlin, sailfish, and spearfish due to insufficient data. Catch and mortality rates were not significantly different for swordfish. Catch rates for sharks were not significantly different but were significantly different for other prohibited species. Computations from observer data showed higher catch rates (0.6603) for other prohibited species than the catch rates computed from Japanese quarterly report data (0.1368). Mortality rates for sharks and other prohibited species were significantly different. Mortality rates computed from observer data were higher for sharks (26.8%) and other prohibited species (51.9%), compared to mortality rates computed from Japanese quarterly report data (15.8% and 29.1% for these same species, respectively).

Second quarter comparisons for the Atlantic (Table 3) indicate no significant differences in the catch and mortality rates for blue marlin, white marlin, spearfish and swordfish. Catch rates for sharks were not significantly different, but mortality rates were different. Qbserver data indicated higher mortality rates for sharks than were

indicated in the Japanese quarterly reports (6.3% vs. 2.4%). For the other prohibited species, catch rates were significantly different. Catch rates from observer data were higher than the catch rates from Japanese quarterly report data (0.7406 vs. 0.3973). Mortality rates were not different.

Third quarter comparisons for the Atlantic (Table 4), indicate catch rates for all reported species, except swordfish, were significantly different. Catch rates computed from observer data were higher than those computed from Japanese quarterly report data for blue marlin (0.0274 vs. 0.0123), white marlin (0.6611 vs. 0.0321), sailfish, (0.0216 vs. 0.0071), spearfish (0.0292 vs. 0102), sharks (0.7902 vs. 0.4966), and other prohibited species (1.2065 vs. 0.2208). Mortality rates for blue marlin, white marlin, sailfish and spearfish were not significantly different in the two reports. Mortality rates were different for sharks with rates computed from observer data being lower than those computed from Japanese quarterly reports (5.8% vs. 8.1%). Mortality rates were also different for other prohibited species with higher mortality being shown in percentages calculated from observer data (74.1% vs. 67.4%).

Fourth quarter comparisons for the Atlantic (Table 5) show significant differences in the catch rates for all reported species. Sailfish' comparisons were not made due to lack of data. For all the species compared, catch rates computed from observer data were

again higher than those computed from Japanese quarterly reports for blue marlin (0.0017 vs. 0.0003), white marlin (0.0155 vs. 0.0046), swordfish (0.1598 vs. 0.1126), sharks (0.9785 vs. 0.5238) and other prohibited species (1.2220 vs. 0.5977). Observer catch rates for spearfish were lower (0.0003 vs. 0048). Mortality rates were not significantly different for blue marlin, white marlin and spearfish; but were significantly different for swordfish, sharks and other prohibited species. Mortality rates computed from observer data were higher than those computed from Japanese quarterly. report data for swordfish (60.6% vs. 49.3%) and other prohibited species (52.6% vs. 32.0%). Mortality rates computed from observer data were lower than those computed from Japanese quarterly report data for sharks (9.1% vs. 11.6%).

Quarterly data from observer and Japanese reports show that more fish were caught in the Atlantic during the third and fourth quarters than were caught during the first and second quarters. In the first two quarters, when numbers of fish caught were lower, catch rates for six of seven reported species were not significantly different. However, in the third and fourth quarters, as the numbers of fish caught increased, catch rates between the two reports did become significantly different for all species, except for third quarter swordfish.

Comparisons of annual catch and mortality rates between observer data and Japanese Quarterly Statistical Reports for the Atlantic (Table 6) indicates the annual catch rates were significantly different for all reported species. Mortality rates were significantly

Table 2 - Comparison of catch rates from observer records and the Japanese Quarterly Report for the first quarter of 1980 in the Atlantic

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}=\mu$	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:$\bar{x}=\mu$
Blue Marlin	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	1	0.0003						00.0		
White Marlin	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	1	0.0003						100.0		
Sailfish	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	0	0.								
Spearfish	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	8	0.0026						12.5		
Swordfish	Observer	35	0.0852	0.0948	0.0380	0.1323	- 0.0716	Accept	60.0	1.0750	Accept
	Japanese	264	0.0868	-	-	-			50.4		
Shark	Observer	273	0.6452	0.3417	0.4752	0.8151	0.6854	Accept	26.8	4,1693	Reject
	Japanese	1794	0.5900	-	-	-			15.8		
Other	Observer	277	0.6603	0.3658	0.4784	0.8422	6.0717	Reject	51.9	6.0807	Reject
	Japanese	416	0.1368	-	-	-			29.1		

Number Sets Observer 18
Japanese 133 **

Number Hooks Observer 41185
Japanese 304058

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data ??? Hypothesis is rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (2288).

Table 3- Comparison of catch rates from-observer records and the Japanese quarterly Report for the Second quarter of 1980 in the Altlantic

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}=\mu$	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:$\bar{x}=\mu$
Blue Marlin	Observer	7	0.0133	0.0314	0.0000	0.0265	-0.9205	Accept	71.4	0.9299	Accept
	Japanese	12	0.0192	-	-	-			50.0		
White Marlin	Observer	21	0.0399	0.0451	0.0208	0.0589	0.8581	Accept	57.1	0.1352	Accept
	Japanese	20	0.0320	-	-	-			55.0		
Sailfish	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	0	-	-	-	-					
Spearfish	Observer	7	0.0133	0.0314	0.0000	0.0265	0.5772	Accept	100.0	0.0000	Accept
	Japanese	6	0.0096	-	-	-			100.0		
Swordfish	Observer	16	0.0294	0.0400	0.0126	0.0463	0.6614	Accept	80.0	0.5031	Accept
	Japanese	15	0.0240	-	-	-			86.7		
Shark	Observer	257	0.4669	0.6469	0.1937	0.7402	0.4544	Accept	06.3	2.2211	Reject
	Japanese	254	0.4069	-	-	-			02.4		
Other	Observer	405	0.7406	0.8097	0.3986	1.0825	2,0771	Reject	88.9	0.4329	Accept
	Japanese	248	0.3973	-	-	-			90.7		

Number Sets Observer 24
Japanese ** 28

Number Hooks Observer 53208
Japanese 62420

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data ??? ??Hypothesis is rejected if the rates are signficantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (2217).

Table 4 - Comparison of catch rates from observer records and the Japanese Quarterly Report for the third quarter of 1980 in the Atlantic

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}=\mu$	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:$\bar{x}=\mu$
Blue Marlin	Observer	86	0.0274	0.0803	0.0139	0.0410	2.2090	Reject	29.1	-1.6834	Accept
	Japanese	211	0.0123	-	-	-			39.3		
White Marlin	Observer	187	0.0611	0.0966	0.0448	0.0774	3.5266	Reject	68.5	0.1592	Accept
	Japanese	550	0.0321	-	-	-			60.9		
Sailfish	Observer	69	0.0216	0.0721	0.0095	0.0338	2.3625	Reject	66.7	0.9903	Accept
	Japanese	121	0.0071	-	-	-			59.5		
Spearfish	Observer	95	0.0292	0.0675	0.0178	0.0406	3.3067	Reject	60.0	-1.0244	Accept
	Japanese	175	0.0102	-	-	-			66.3		
Swordfish	Observer	140	0.0450	0.0696	0.0333	0.0568	1.1984	Accept	76.4	3.0153	Reject
	Japanese	649	0.0379	-	-	-			63.6		
Shark	Observer	2434	0.7902	0.9327	0.6331	0.9474	3.6979	Reject	05.8	-3,9483	Reject
	Japanese	8514	0.4966	-	-	-			08.1		
Other	Observer	3783	1.2065	0.7656	1.0715	1.3355	15.1245	Reject	74.1	6.4222	Reject
	Japanese	3785	0.2208	-	-	-			67.4		

Number Sets	Observer	138
	Japanese	755**
Number Hooks	Observer	313187
	Japanese	1714383

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean-rate computed from Japanese Quarterly Report data ???? Hypothesis is rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (2270).

Table 5 - Comparison of catch rates from observer records and the Japanese Quarterly Report for the fourth quarter of 1980 in the Atlantic-

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:x=μ	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:x=μ
Blue Marlin	Observer	6	0.0017	0.0085	0.0003	0.0030	2.0700	Reject	50.0	-0.3326	Accept
	Japanese	5	0.0003	-	-	-			60.0		
White Marlin	Observer	53	0.0155	0.0547	0.0069	0.0241	2.5048	Reject	69.8	0.4816	Accept
	Japanese	79	0.0046	-	-	-			65.8		
Sailfish	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	2	0.0001	-	-	-			50.0		
Spearfish	Observer	1	0.0003	0.0033	-0.0003	0.0000	-17.1406	Reject	100.0	1.5852	Accept
	Japanese	82	0.0048	-	-	-			48.8		
Swordfish	Observer	607	0.1598	0.2066	0.1273	0.1923	2.8717	Reject	60.6	4.8858	Reject
	Japanese	1915	0.1126	-	-	-			49.3		
Shark	Observer	3679	0.9785	1.2047	0.7890	1.1680	4.7443	Reject	09.1	-4.1857	Reject
	Japanese	8912	0.5238	-	-	-			11.6		
Other	Observer	4603	1.2220	0.9898	1.0663	1.3777	7.9282	Reject	52.6	23.6564	Reject
	Japanese	10169	0.5977	-	-	-			32.0		

Number Sets	Observer	158
	Japanese	719 **
Number Hooks	Observer	373825
	Japanese	1701365

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data ??? Hypothesis rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (2366).

Table 6- Comparison of catch rates from observer records and the Japanese Quarterly Report for 1980 in the Atlantic

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:x=μ	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:x=μ
Blue Marlin	Observer	99	0.0129	0.0536	0.0072	0.0187	2.3324	Reject	33.3	-1.1927	Accept
	Japanese	229	0.0061	-	-	-			40.2		
White Marlin	Observer	261	0.0350	0.0765	0.0268	0.0432	4.6778	Reject	67.8	1.8929	Accept
	Japanese	650	0.0172	-	-	-			61.4		
Sailfish	Observer*	69	0.0088	0.0472	0.0038	0.0139	2.1423	Reject	66.7	1.0218	Accept
	Japanese	123	0.0033	-	-	-			59.3		
Spearfish	Observer	103	0.0130	0.0460	0.0081	0.0179	2.3181	Reject	62.1	0.3528	Accept
	Japanese	271	0.0072	-	-	-			60.1		
Swordfish	Observer	798	0.0997	0.1603	0.0826	0.1169	2.8099	Reject	63.7	5.4804	Reject
	Japanese	2843	0.0752	-	-	-			52.9		
Shark	Observer	6643	0.8476	1.0422	0.7360	0.9591	5.8689	Reject	08.5	-4.5692	Reject
	Japanese	19474	0.5149	-	-	-			10.4		
Other	Observer	9068	1.1516	0.8802	1.0574	1.2458	15.9807	Reject	63.2	31.8563	Reject
	Japanese	14618	0.3865	-	-	-			42.1		

Number Sets Observer 338
Japanese 1636 **

Number Hooks Observer 781397
Japanese 3782226

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data (m). Hypothesis is rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (2366).

different for swordfish, sharks and other prohibited species; but were not significantly different for blue marlin, white marlin, sailfish and swordfish.

3.2.2 GULF OF MEXICO

Comparisons for differences between quarterly catch and mortality rates computed from observer data and Japanese Quarterly Statistical Reports for the Gulf of Mexico are shown in Tables 7-8.

Results of comparisons from first quarter data (Table 7), indicates significant catch rate differences for blue marlin, white marlin, swordfish, sharks and other prohibited species. Catch rates computed from observer data were higher than those computed from Japanese quarterly report data for blue marlin (0.0112 vs. 0.0058), white marlin (0.0535 vs. 0.0267), swordfish (0.2145 vs. 0.1136), sharks (0.1697 vs. 0.0954) and other prohibited species (0.3362 vs. 0.0899). Catch rates were not significantly different for sailfish and spearfish. Mortality rates were significantly different for white marlin, spearfish, swordfish and other prohibited species. Mortality rates from observer data were higher than the mortality rates computed from Japanese quarterly report data for white marlin (49.1% vs. 35.8%), swordfish (81.1% vs. 65.6%), and other prohibited species (48.2% vs. 28.2%). Mortality rates from observer data were lower than the rates from Japanese quarterly report data for spearfish (10.0% vs. 37.6%). Mortality rates were not significantly different for blue marlin, sailfish

and sharks.

Second quarter comparisons for the Gulf of Mexico are shown in Table 8. Catch and mortality rate comparisons were not made for blue marlin, white marlin and spearfish due to insufficient data. Significant differences were not indicated in the catch rates for sailfish, swordfish, sharks or other prohibited species. Significant differences were not indicated in mortality rates for sailfish, sharks and other prohibited species. Significant differences in mortality were noted for swordfish, with rates computed from observer data being higher than those computed from Japanese quarterly report data for this species (88.9% vs. 60.0%).

Comparisons of the annual catch and mortality rates from observer data and Japanese Quarterly Statistical Reports for 1980 in the Gulf of Mexico are shown in Table 9. Significant differences in catch rates are indicated for blue marlin, white marlin, swordfish, sharks and other prohibited species. Computed catch rates from observer data were higher than the rates from Japanese quarterly report data for blue marlin (0.0107 vs. 0.0058), white marlin (0.0511 vs. 0.0262), swordfish (0.2112 vs. 0.1129), sharks (0.1641 vs. 0.0953) and other prohibited species (0.3382 vs. 0.0915). Catch rates were not significantly different for sailfish and spearfish. Mortality rates were significantly different for white marlin, spearfish, swordfish and other prohibited species. Observer data indicated higher mortalities than those computed from Japanese quarterly report data for white marlin (49.1% vs. 35.9%), swordfish (81.3% vs. 65.5%) and other prohibited species (46.5% vs. 27.6%). Observer mortality rates were lower for spearfish (10.0% vs. 39.1%). Mortality rates were not significantly different for blue marlin, sailfish and sharks.

Table 7 - Comparison of catch rates. from observer records and the Japanese Quarterly Report for the first quarter of 1980 in the Gulf of Mexico

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}=\mu$	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:$\bar{x}=\mu$
Blue Marlin	Observer	36	0.0112	0.0265	0.0069	0.0155	2.4874	Reject	50.0	1.2003	Accept
	Japanese	104	0.0058	-	-	-			38.5		
White Marlin	Observer	171	0.0535	0.0825	0.0402	0.0669	3.9653	Reject	49.1	3.0084	Reject
	Japanese	478	0.0267	-	-	-			35.8		
Sailfish	Observer	12	0.0037	0.0153	0.0012	0.0062	1.6754	Accept	58.3	0.2752	Accept
	Japanese	28	0.0016	-	-	-			53.6		
Spearfish	Observer	10	0.0031	0.0118	0.0012	0.0050	1.6551	Accept	10.0	-2.0244	Reject
	Japanese	85	0.0047	-	-	-			37.6		
Swordfish	Observer	614	0.2145	0.2991	0.1660	0.2630	4.1178	Reject	81.1	7.6859	Reject
	Japanese	2033	0.1136	-	-	-			65.6		
Shark	Observer	510	0.1697	0.2007	0.1372	0.2022	4.5189	Reject	23.5	1.0445	Accept
	Japanese	1708	0.0954	-	-	-			21.3		
Other	Observer	943	0.3362	0.4098	0.2698	0.4027	7.3364	Reject	48.2	10.1183	Reject
	Japanese	1608	0.0899	-	-	-			28.2		

Number Sets	Observer	149
	Japanese	947 **
Number Hooks	Observer	281473
	Japanese	1769559

*Hypothesis(H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data (m). Hypothesis is rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (1889).

Table 8 - Comparison of catch rates from observer records and the Japanese Quarterly Report for the second quarter of 1980 in the Gulf of Mexico

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}=\mu$	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:$\bar{x}=\mu$
Blue Marlin	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	3	0.0072	-	-	-			66.6		
White Marlin	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	1	0.0024	-	-	-			100.0		
Sailfish	Observer	1	0.0069	0.0112	-0.0100	0.0238	0.6542	Accept	100.0	0.0000	Accept
	Japanese	1	0.0024	-	-	-			100.0		
Spearfish	Observer	0	No Data	-	-	-	-	-	-	-	-
	Japanese	2	0.0048	-	-	-			100.0		
Swordfish	Observer	18	0.1416	0.1392	0.0128	0.2703	1.0834	Accept	88.9	2.3791	Reject
	Japanese	35	0.0846	-	-	-			60.0		
Shark	Observer	6	0.0451	0.0611	-0.0113	0.1016	-2.0222	Accept	16.7	-0.9272	Accept
	Japanese	38	0.0918	-	-	-			34.2		
Other	Observer	47	0.3791	0.3073	0.0948	0.6633	1.8700	Accept	12.8	-0.2220	Accept
	Japanese	67	0.1619	-	-	-			14.9		

Number Sets	Observer	7
	Japanese	23 **
Number Hooks	Observer	12824
	Japanese	41390

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data (m). Hypothesis is rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (1832).

Table 9- Comparison of catch rates from observer records and the Japanese Quarterly Report for 1980 in the Gulf of Mexico

Species	Report	Number Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}=\mu$	Mortality (% Dead)	t-Test for Diff. Between Mortalities (95% Confidence)* t	H:$\bar{x}=\mu$
Blue Marlin	Observer	36	0.0107	0.0260	0.0066	0.0148	2.3539	Reject	50.0	1.1196	Accept
	Japanese	107	0.0058	-	-	-			39.3		
White Marlin	Observer	171	0.0511	0.0814	0.0382	0.0640	3.8206	Reject	49.1	3.0053	Reject
	Japanese	479	0.0262	-	-	-			35.9		
Sailfish	Observer	13	0.0038	0.0154	0.0014	0.0063	1.7843	Accept	61.5	0.3838	Accept
	Japanese	29	0.0016	-	-	-			55.2		
Spearfish	Observer	10	0.0030	0.0115	0.0012	0.0048	-1.9550	Accept	10.0	-2.1189	Reject
	Japanese	87	0.0048	-	-	-			39.1		
Swordfish	Observer	632	0.2112	0.2939	0.1647	0.2578	4.1775	Reject	81.3	7.9482	Reject
	Japanese	2068	0.1129	-	-	-			65.5		
Shark	Observer	516	0.1641	0.1981	0.1327	0.1955	4.3378	Reject	23.4	0.8637	Accept
	Japanese	1745	0.0953	-	-	-			21.6		
Other	Observer	990	0.3382	0.4051	0.2740	0.4023	7.6062	Reject	46.5	9.8387	Reject
	Japanese	1675	0.0915	-	-	-			27.6		

Number Sets	Observer	156
	Japanese	970 **
Number Hooks	Observer	294297
	Japanese	1830949

*Hypothesis (H) being tested is the mean rate computed from observer data (x) is equal to the mean rate computed from Japanese Quarterly Report data (m). Hypothesis is rejected if the rates are significantly different at the 95% confidence level.

**Japanese number of sets estimated by dividing total hooks reported by the mean number of hooks per set recorded by observers (1887).

Observers also recorded species of turtles and marine mammals caught in the Atlantic and Gulf of Mexico by foreign fishing vessels. Numbers caught, catch rates and mortalities are listed in Tables 10 and 11. Comparable data were not provided in the Japanese quarterly reports.

3.3 TOTAL ANNUAL CATCH

Total annual catches of species hooked in the Atlantic (Table 12 and Gulf of Mexico (Table 13) were computed from observer data as:

$$H_i = \frac{\bar{X}_i \times JH}{100} \qquad (5)$$

where: Hi = total number hooked of species i

$\bar{X}_i$ = mean observer catch rate/100 hooks for species i, and

Jh = total Japanese hooks

An additional total catch estimate was computed by converting the number of days reported to EMIS by area into an estimate of the number of hooks fished. The EMIS estimated hook number was derived as:

$$Eeh = Ed \times \%df \times \bar{x}hs \qquad (6)$$

where: Eeh = EMIS estimated hooks,

Ed = EMIS days reported by area (Table 1) in the FCZ,

%df = % days fished (Atlantic 79.7% and Gulf 81.9%) computed from observer data (No. of observer days fished ? total observer days x 100), and

$\bar{x}hs$ = mean hooks per set (Atlantic 2312 and Gulf 1887) computed from observer data.

The EMIS estimated hook number was then used to compute the EMIS

Table 10 - Observed catches of sea turtles and marine mammals in the Atlantic for 1980

Species	No. Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	Mortality (%)
Turtle Unidentified	4	0.0005	0.0061	-0.0001	0.0012	00.0
Leatherback	2	0.0002	0.0028	-0.0001	0.0005	00.0
Green	2	0.0002	0.0032	-0.0001	0.0006	100.0
Loggerhead	2	0.0003	0.0035	-0.0001	0.0007	50.0
False Killer Whale	6	0.0008	0.0072	0.0001	0.0016	16.8

No. of Sets 338

No. Hooks 781397

Table 11 - Observed catches of sea turtles and marine mammals in the Gulf of Mexico for 1980

Species	No. Caught	Mean Catch/100 Hooks	Standard Deviation	95% Confidence Limits Lower	Upper	Mortality (%)
Turtle Unidentified	1	0.0003	0.0035	-0.0003	0.0008	00.0
Leatherback	7	0.0021	0.0112	0.0004	0.0039	00.0
Green	0	-	-	-	-	-
Loggerhead	0	-	-	-	-	-
False Killer Whale	0	-	-	-	-	-

No. of Sets 156

No. Hooks 294297

total catch estimates.

3.3.1 ATLANTIC

Observer estimates of total annual catch computed from the two estimates of effort, Japanese hook reports and EMIS estimated hooks, were compared to the Japanese reported catch (Table 12). Japanese reported total annual catches for the seven reported species were consistently lower than observer estimated total annual catches. Of the seven species reported, only one species fell within the estimated total catch range 95% confidence limits of either observer estimate. Swordfish was within the estimated total catch range computed from EMIS hook data.

Observer estimated total annual catches computed from EMIS hook data were slightly lower than the estimated total annual catches computed from Japanese hook reports. However, overlap is evident in the confidence limits of both data sets.

3.3.2 GULF OF MEXICO

Comparisons of observer estimated total annual catches and Japanese reported total annual catches are shown in Table 13. Japanese total annual catch for three of seven reported species, sailfish, spearfish and swordfish, were within the confidence limits of the observer total annual catch estimates computed from Japanese hook reports. Two species, sailfish and spearfish, were within the observer total annual catch estimates computed from EMIS hook data (sailfish

and spearfish were within range of both observer estimates). Total annual catches from Japanese reports were lower than observer estimated total annual catch for blue marlin, white marlin, sharks and other prohibited species.

Observer estimated total annual catches computed from Japanese hook reports were slightly higher than the estimated total annual catches computed from EMIS hook reports, but overlap is evident in the confidence limits of both estimates.

Table 12 - Comparison of Total Japanese Reported 1980 Catches for the Atlantic

Species	Japanese Reports	Observer Estimates: Japanese Hook Reports* Catch	95% Conf. (±)	EMIS Estimated Hooks** Catch	95% Conf. (±)
Blue Marlin	229	488	216	439	194
White Marlin	650	1324	310	1191	279
Sailfish	123	333	189	299	170
Spearfish	271	492	185	442	167
Swordfish	2843	3771	647	3393	582
Sharks	19474	32058	4221	28847	3798
Other Fish	14618	43556	3563	39194	3206
Unidentified Turtles	-	19	23	17	20
Leatherback Turtles	-	8	11	7	7
Green Turtles	-	8	11	7	7
Loggerhead Turtles	-	11	15	10	14
False Killer Whales	-	30	26	27	24

*Japanese Report 3782226 hooks

**EMIS Estimated 3403400 hooks

Table 13 - Comparison of Total Japanese Reported 1980 Catches for the Gulf of Mexico

Species	Japanese Reports	Observer Estimates: Japanese Hook Reports* Catch	95% Conf.(±)	EMIS Estimated Hooks** Catch	95% Conf.(±)
Blue Marlin	107	196	75	185	71
White Marlin	479	936	236	881	222
Sailfish	29	70	44	66	41
Spearfish	87	55	33	52	31
Swordfish	2068	2867	851	3643	802
Sharks	1745	3005	575	2830	542
Other Fish	1675	6192	1175	5833	1107
Unidentified Turtles	-	5	11	5	10
Leatherback Turtles	-	38	31	36	29
Green Turtles	-	-	-	-	-
Loggerhead Turtles	-	-	-	-	-
False Killer Whales	-	-	-	-	-

*Japanese Reported 1830949 hooks

**EMIS Estimated 1724726 hooks

Table 12 - Comparison of Total Japanese Reported 1980 Catches for the Atlantic

Species	Japanese Reports	Observer Estimates: Japanese Hook Reports* Catch	Japanese Hook Reports* 95% Conf. (±)	EMIS Estimated Hooks** Catch	EMIS Estimated Hooks** 95% Conf. (±)
Blue Marlin	229	488	216	439	194
White Marlin	650	1324	310	1191	279
Sailfish	123	333	189	299	170
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Unidentified Turtles	-	19	23	17	20
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Green Turtles	-	8	11	7	7
Loggerhead Turtles	-	11	15	10	14
False Killer Whales	-	30	26	27	24

*Japanese Report 3782226 hooks

**EMIS Estimated 3403400 hooks

Table 13 - Comparison of Total Japanese Reported 1980 Catches for the Gulf of Mexico

Species	Japanese Reports	Observer Estimates: Japanese Hook Reports* Catch	Japanese Hook Reports* 95% Conf.(±)	EMIS Estimated Hooks** Catch	EMIS Estimated Hooks** 95% Conf.(±)
Blue Marlin	107	196	75	185	71
White Marlin	479	936	236	881	222
Sailfish	29	70	44	66	41
Spearfish	87	55	33	52	31
Swordfish	2068	2867	851	3643	802
Sharks	1745	3005	575	2830	542
Other Fish	1675	6192	1175	5833	1107
Unidentified Turtles	-	5	11	5	10
Leatherback Turtles	-	38	31	36	29
Green Turtles	-	-	-	-	-
Loggerhead Turtles	-	-	-	-	-
False Killer Whales	-	-	-	-	-

*Japanese Reported 1830949 hooks

**EMIS Estimated 1724726 hooks

SECTION 4.0

COMPARISON BETWEEN 1979 AND 1980 FISHING DATA

4.1 FISHING EFFORT

Japanese vessel activity within the FCZ was plotted from noonday positions given in the Japanese Quarterly Statistical Reports for 1979. and 1930 (Figure 9). Except for a shift in fishing effort from Zone 13 in 1979 to Zone 14 in 1980, vessel activity was generally distributed throughout the same geographical areas of the Atlantic and Gulf of Mexico during both years.

4.2 CATCH AND MORTALITY

Annual catch rates and capture mortalities derived from observer data for 1979 and 1980 are summarized for the Atlantic and Gulf of Mexico (Tables 14115). The data are presented in the same species format used for the annual catch summaries for the 1979 and 1980 reports.

Comparisons were made between the 1979 and 1980 data to determine if catch rates and capture mortalities for each species were the same for both years in the Atlantic and Gulf of Mexico. Catch rate evaluations were made using the t-test:

$$t = \frac{\bar{x}_{80} - \bar{x}_{79}}{\sqrt{\frac{s_{80}^2}{n_{80}} + \frac{s_{79}^2}{n_{79}}}} \qquad (7)$$

where: $\bar{x}_{80}$ = mean observer catch rate/100 hooks for species i for 1980,

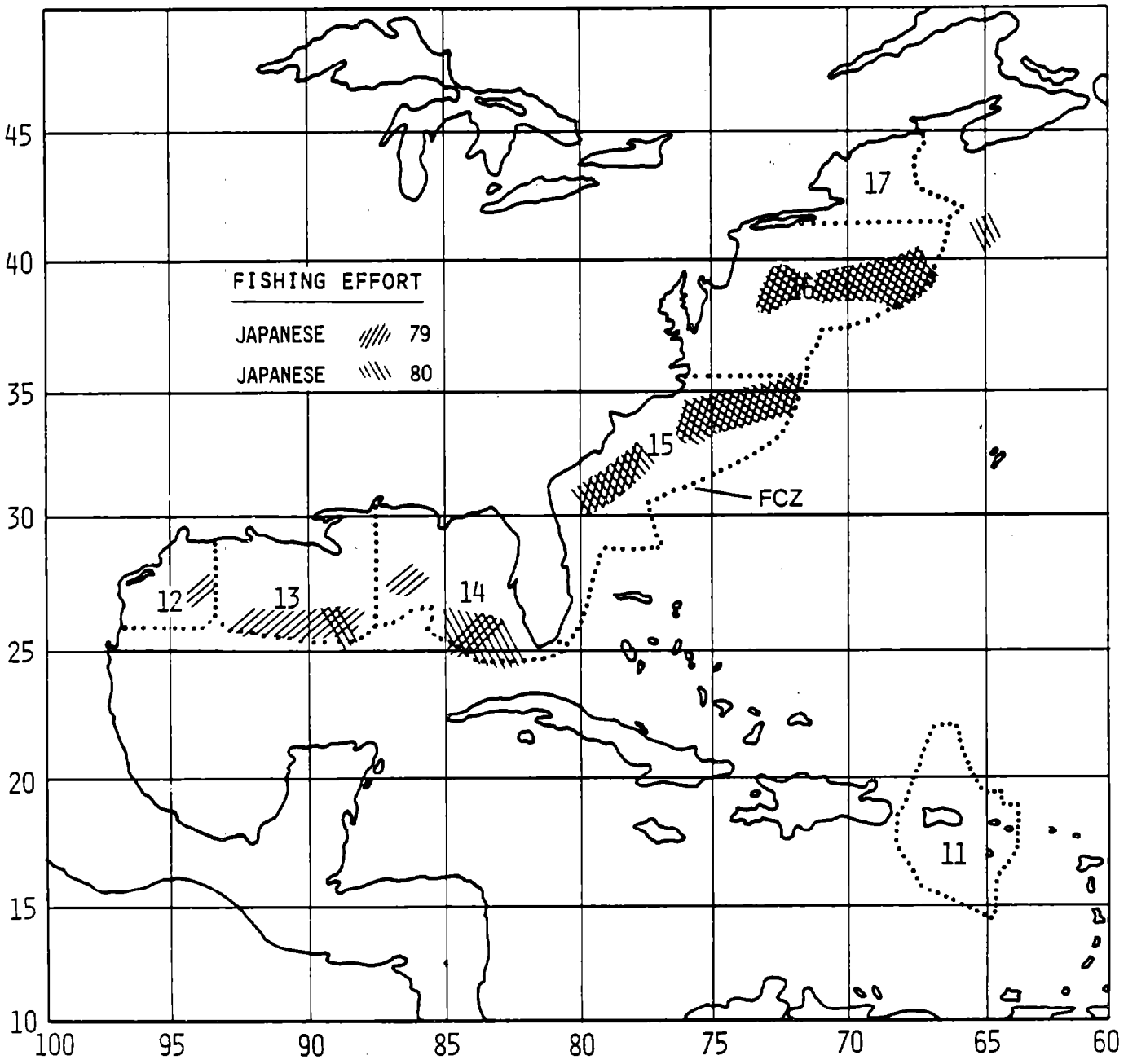

Figure 9. Japanese fishing effort, 1979 and 1980.

$\bar{x}_{79}$ = mean observer catch rate/100 hooks for species i in 1979,

s^2_{80} = catch rate variance for species i for 1980,

s^2_{79} = catch rate variance for species i for 1979,

n_{80} = number of sets made in 1980, and

n_{79} = number of sets made in 1979.

Capture mortality percentages derived for 1980 observer data were compared with observer mortality percentages for 1979 using the t-test:

$$t = \frac{\text{arcsine}\sqrt{P_{80}} - \text{arcsine}\sqrt{P_{79}}}{\sqrt{820.8\left(\frac{1}{T_{80}} + \frac{1}{T_{79}}\right)}} \qquad (8)$$

where: P_{80} = dead proportion of species i reported by observers in 1980,

P_{79} = dead proportion of species i reported by observers in 1979,

T_{80} = number dead + number alive of species reported by observers in 1980,

T_{79} = number dead + number alive of species i reported by observers in 1979, and

820.8 = constant representing the parametric variance of a

distribution of arcsine transformation properties.

4.2.1 ATLANTIC

Comparisons of catch rates and capture mortalities (percent dead) from 1979 and 1980 observer data for the Atlantic is presented in Table 14. The results of comparisons between 1979 and 1980 data for the Atlantic indicate catch rates for blue marlin, white marlin, spearfish, swordfish and sharks were significantly different for the two years. Catch rates were not significantly different for sailfish and other prohibited species. A review of observer catch rates for 1979 and 1980 indicates a decrease in the 1980 catch rates for blue marlin, white marlin, sailfish, spearfish and sharks. Catch rates for swordfish, and other prohibited species were higher in 1980 than in 1979.

The results of comparisons of capture mortalities in the Atlantic for 1979 and 1980 indicate capture mortalities for white marlin, swordfish, sharks and other prohibited species were significantly different for the two years. Capture mortalities were not significantly different for blue marlin, sailfish and spearfish. A review of the capture mortalities shows a decrease in 1980 mortality percentages for all species except white marlin and sharks.

4.2.2 GULF OF MEXICO

Comparisons of the 1979 and 1980 observer data for the Gulf of

Mexico (Table 15) indicate catch rates were significantly different each year for white marlin, swordfish, sharks and other prohibited species. Catch rates were not significantly different for blue marlin, sailfish and spearfish.

While catch rates were significantly different between the years for four of the species reported from the Gulf (white marlin, swordfish, shark and other fishes), it is interesting to note that the number caught and the computed catch rates increased from 1979 to 1980 for all species reported. This occurred even though sixty-four percent fewer hooks were set in 1980 than in 1979.

4.3 TOTAL ANNUAL CATCHES

Total annual catch rates from observer estimates based on EMIS estimated hooks are summarized for the Atlantic and Gulf of Mexico for 1979 and 1980 (Tables 16 and 17). Japanese-reported catches for both years also are included in these summaries.

4.3.1 ATLANTIC

Observer estimated total annual catch for the Atlantic in 1979 and 1980 were compared which showed the estimated total catch for white marlin and spearfish declined from 1979 to 1980. Total catch declines also were noted in 1980 for blue marlin and sailfish. However, these declines were not significant. Estimated total catch increased from 1979 to 1980 for swordfish, sharks and other prohibited fishes.

Japanese reported total annual catch from the Atlantic in 1979 and 1980 were compared to the observer estimated total catch for the same time periods. The comparisons indicate the Japanese reports for total catch were lower than the observer estimated total catch for all species during both years. The Japanese reported total catch for blue marlin, white marlin, spearfish, sharks and other prohibited fishes were significantly less than the observer estimated total catches for both years. Total catch for swordfish was not within observer total catch range in 1979, but was within range in 1980. Total catch of sailfish were within estimated total catch range in 1979 but was not within catch range in 1980.

4.3.2 GULF OF MEXICO

Comparisons of observer estimated total annual catch for the Gulf in 1979 and 1980 (Table 17) reveal an increase in the 1980 estimated total catch for all reported species. The most significant increases are shown in the estimated total annual catch of white marlin, sailfish and other prohibited fishes where no overlap is shown in the total annual catch ranges of the 95% confidence intervals for both years. The blue marlin, spearfish, swordfish and sharks which also showed an increase in the total catch from 1979 to 1980, showed overlap in the total annual catch range.

The Japanese reported total catch for the Gulf in 1979 and 1980

were compared to the observer estimated total annual catch for both years. The increase in estimated total annual catch shown for all reported species in 1980 is not reflected in the Japanese reported total catch for 1980, especially for swordfish, sharks and other prohibited fishes.

Table 14 - Comparison of catch rates and mortality from observer data from the Atlantic, 1979 versus 1980

Species	Report/Year	Number Caught	Mean Catch/100 Hooks	Standard Deviation	t-Test for Diff. Between Catch Rates (95% Confidence)* t	H:$\bar{x}_{80}=\bar{x}_{79}$	Mortality	t-Test for Diff. Between Mortality (95% Confidence)* t	H:$\bar{x}_{80}=\bar{x}_{79}$
Blue Marlin	Observer-1979	173	0.0265	0.0519	3.2380	Reject	43.0	1.6399	Accept
	Observer-1980	99	0.0129	0.0129			33.0		
White Marlin	Observer-1979	898	0.1332	0.1986	11.9756	Reject	62.2	1.6766	Reject
	Observer-1980	261	0.0350	0.0765			67.8		
Sailfish	Observer-1979	105	0.0163	0.0487	0.1315	Accept	72.4	0.7995	Accept
	Observer-1980	69	0.0088	0.0472			66.7		
Spearfish	Observer-1979	205	0.0317	0.0775	2.6714	Reject	64.2	0.3612	Accept
	Observer-1980	103	0.0130	0.0460			62.1		
Swordfish	Observer-1979	511	0.0778	0.1699	2.2872	Reject	73.0	3.4788	Reject
	Observer-1980	798	0.0997	0.1603			63.7		
Shark	Observer-1979	6228	0.9209	0.9906	4.0949	Reject	6.8	3.6309	Reject
	Observer-1980	6643	0.8476	1.0422			8.5		
Other	Observer-1979	7523	1.1363	0.1791	1.6105	Accept	60.5	3.5827	Reject
	Observer-1980	9068	1.1516	0.8802			63.2		
Number Sets	Observer-1979	295							
	Observer-1980	338							
Number Hooks	Observer-1979	663551							
	Observer-1980	781397							

*Hypothesis (H) being tested is the mean catch rate computed from observer data in 1980 ($\bar{x}_{80}$) is equal to the mean catch rate computed from observer data in 1979 ($\bar{x}_{79}$) Hypothesis is rejected if significantly different at the 95% confidence level.

Table 15 - Comparison of catch rates and mortality from observer data from the Gulf of Mexico, 1979 versus 1980

Species	Report/Year	Number Caught	Mean Catch/100 Hooks	Standard Deviation	t-Test for Diff. Between Catch Rates (95% Confidence)* t	$H:\bar{x}_{80}=\bar{x}_{79}$	Mortality	t-Test for Diff. Between Mortality (95% Confidence)* t	$H:\bar{x}_{80}=\bar{x}_{79}$
Blue Marlin	Observer-1979	24	0.0054	0.0160	0.3759	Accept	62.5	0.9589	Accept
	Observer-1980	36	0.0107	0.0260			50.0		
White Marlin	Observer-1979	41	0.0089	0.0199	6.071	Reject	61.0	1.3795	Accept
	Observer-1980	171	0.0511	0.0814			49.1		
Sailfish	Observer-1979	1	0.0002	0.0031	0.6792	Accept	0.0	1.7372	Accept
	Observer-1980	13	0.0038	0.0154			61.5		
Spearfish	Observer-1979	1	0.0002	0.0031	0.5833	Accept	100.0	2.3817	Accept
	Observer-1980	10	0.0030	0.0115			10.0		
Swordfish	Observer-1979	377	0.0835	0.0827	10.2984	Reject	76.5	1.8172	Accept
	Observer-1980	632	0.2112	0.2939			81.3		
Shark	Observer-1979	366	0.0799	0.1106	8.0190	Reject	15.8	3.1224	Reject
	Observer-1980	516	0.1641	0.1981			23.4		
Other	Observer-1979	533	0.1189	0.1048	16.0073	Reject	69.3	8.6753	Reject
	Observer-1980	990	0.3382	0.4051			46.5		
Number Sets	Observer-1979	199							
	Observer-1980	156							
Number Hooks	Observer-1979	451902							
	Observer-1980	294297							

*Hypothesis (H) being tested is the mean catch rate computed from observer data in 1980 ($\bar{x}_{80}$) is equal to the mean catch rate computed from observer data in 1979 ($\bar{x}_{79}$) Hypothesis is rejected if significantly different at the 95% confidence level.

Table 16 - Comparison of Japanese reported total catches and observer estimated total annual catches - Atlantic, 1979 and 1980

Species	Japanese Quarterly Statistical Reports		Observer Estimates EMIS Estimated Hooks			
			1979		1980	
	1979 Total Catch	1980 Total Catch	Total Catch	95% Conf.(±)	Total Catch	95% Conf.(±)
Blue Marlin	321	229	730	162	439	194
White Marlin	2383	650	3668	625	1191	279
Sailfish	300	123	449	154	299	170
Spearfish	529	271	873	245	442	167
Swordfish	1340	2843	2143	537	3393	582
Sharks	20603	19474	25361	3112	28847	3798
Other Fish	7019	14618	31293	562	39194	3206
Unidentified Turtles	--	--	30	19	17	20
Leatherback Turtles	--	--	--	--	7	7
Green Turtle	--	--	--	--	7	7
Loggerhead Turtle	--	--	36	28	10	14
False Killer Whale	--	--	8	17	27	24

EMIS Estimated Hooks	1979	2753923
	1980	3403400
Japanese Reported Hooks	1979	2696385
	1980	3782226

Table 17 - Comparison of Japanese reported total catches and observer estimated total annual catches - Gulf of Mexico, 1979 and 1980

Species	Japanese Quarterly Statistical Reports		Observer Estimates EMIS Estimated Hooks			
			1979		1980	
	1979 Total Catch	1980 Total Catch	Total Catch	95% Conf.(±)	Total Catch	95% Conf.(±)
Blue Marlin	78	107	184	75	185	71
White Marlin	342	479	304	92	881	222
Sailfish	27	29	7	14	66	41
Spearfish	33	87	7	14	52	31
Swordfish	2450	2068	2849	396	3643	802
Sharks	3105	1745	2726	525	2830	542
Other Fish	1719	1675	4056	481	5833	1107
Unidentified Turtles	--	--	75	51	5	10
Leatherback Turtles	--	--	14	20	36	29
Green Turtle	--	--	--	--	--	--
Loggerhead Turtle	--	--	--	--	--	--
False Killer Whale	--	--	--	--	--	--

EMIS Estimated Hooks	1979	3540331
	1980	1724726
Japanese Reported Hooks	1979	3411587
	1980	1830949

SECTION 5.0

GEOGRAPHICAL DISTRIBUTION OF 1979 AND 1980 FISHING ACTIVITY

Summaries of the geographical distribution of Japanese longline fishing effort, catch rates by selected species and total catch were developed for a special SEFC internal report entitled, "Geographical Plots of Japanese Fishing Activities in 1979 and 1980" (December, 1981).

5.1 FISHING EFFORT

The distribution of fishing effort is described in a series of effort plots in 1^{o} squares. The plots are shown as truncated percentages of total hooks fished for specified areas and years. Truncation means that a percentage of 0.8 would be plotted as 0, 1.2 as 1 and 2.0 as 2. The truncated percentages were computed by summing all reported hooks in 1^{o} squares, and dividing the individual sums by summation of the total hooks fished for all squares for the respective area and year. The quotient was multiplied by 100 to express it as a percentage, i.e.,

$$Pi = \sum_{j=1}^{ni} Y_{ij} \, (100) / \Sigma Y_i \qquad (9)$$

where Pi = the truncated percentage of the i-th 1^{o} square,

Yi = the total hooks reported for j-th vessel,

n = the number of totals (i.e., number of reporting vessels accumulated in a 1^{o} square),

Percentage plots were positioned in the approximate center of the 1^{o} squares. Data from Japanese Quarterly Statistical Reports were used

for all computations for total hooks.

5.1.1 ATLANTIC

Truncated percentages for more than 2,696,000 hooks set in the Atlantic, 1979, are geographically plotted in Figure 10. The effort distribution patterns indicate fishing activity was concentrated in an area approximately 33°-42° north latitude, 72°-76° west longitude. Two areas of fishing activity were located within the above boundaries. More than 35% of the total hooks were set in the area 34°-38° north latitude, 72°-76° west longitude. The second area of fishing activity was located approximately 38°-42° north latitude, 66°-79° west longitude, where more than 32% of the total hooks were set.

The 1980 geographical plot showing fishing effort distribution percentages in the Atlantic, 1980, is shown in Figure 11. The patterns derived from 3,782,000 total hooks set during the year indicate the major fishing activity occurred in an area 38°-41° north latitude, 66°-74° west longitude. More than 64% of the total hooks were set in this area. A small amount of fishing activity was located approximately 35°-37° north latitude, 74° west longitude.

A geographical plot of fishing effort combined from 1979 and 1980, representing more than 6,500,000 hooks set, is shown in Figure 12. During the two-year period, major fishing activity was distributed in the general area 38°-41° north latitude, 66°-74° west longitude. More than 49% of the total hooks were set in this area. The second area of fishing was generally located 33°-37° north latitude, 72°-75° west

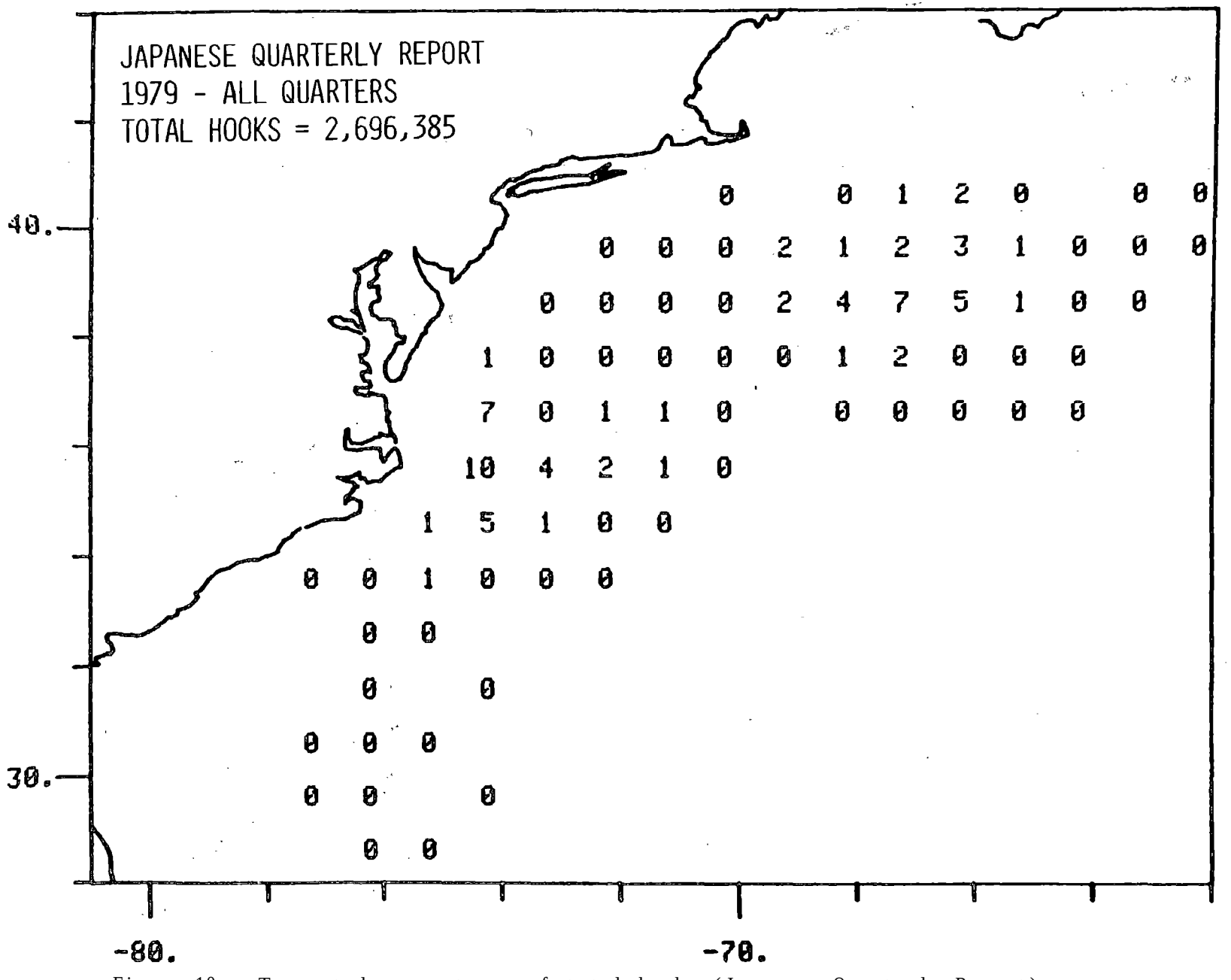

Figure 10. Truncated percentages of total hooks (Japanese Quarterly Report), Atlantic - 1979

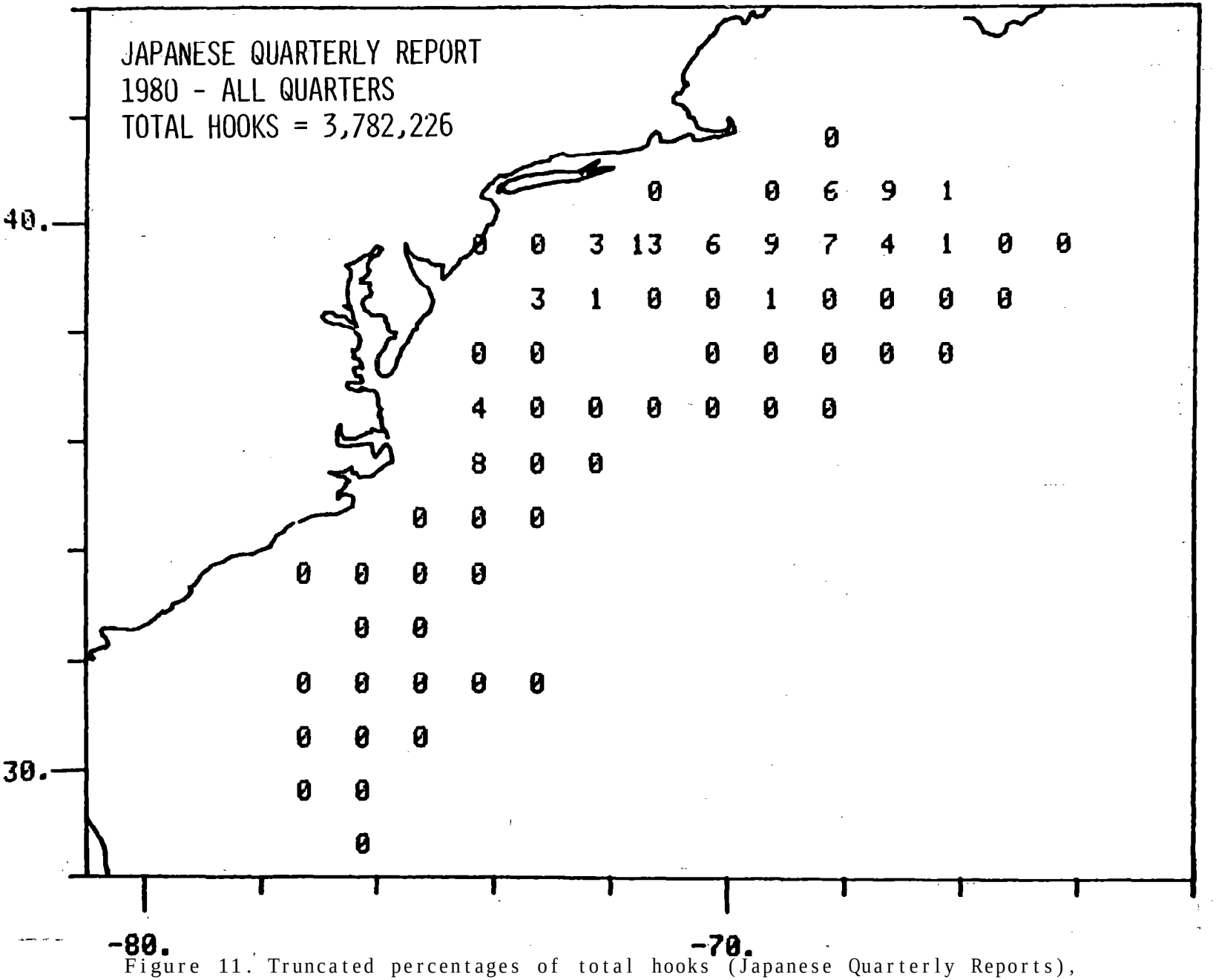

Figure 11. Truncated percentages of total hooks (Japanese Quarterly Reports), Atlantic - 1980

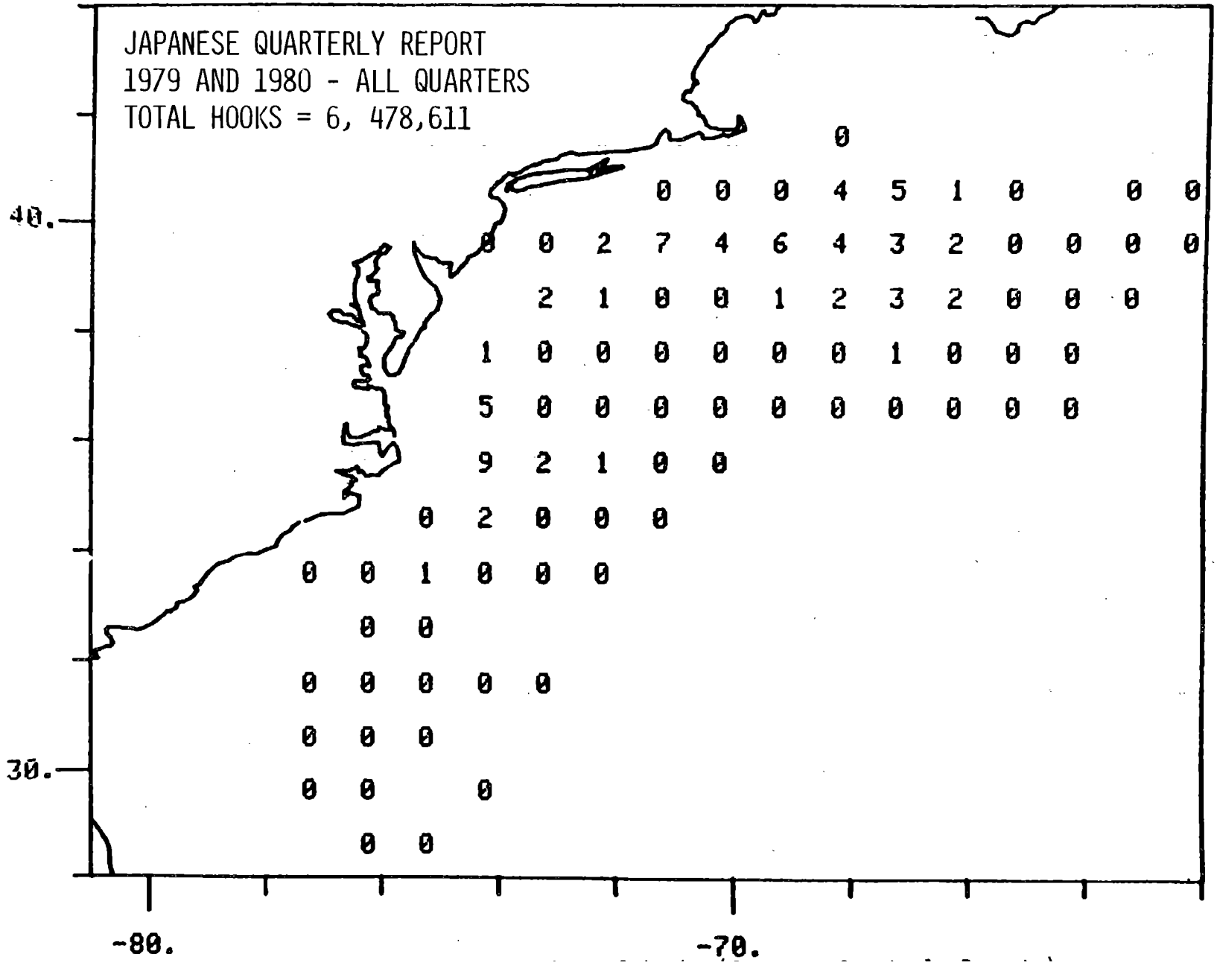

Figure 12. Truncated percentages of total hooks (Japanese Quarterly Reports), Atlantic - 1979 and 1980

longitude. More than 20% of the total hooks were set in this area. During the 1979-1980 period, fishing effort was distributed throughout the same general areas.

5.1.2 GULF OF MEXICO

Percentage plots of fishing effort based on 3,540,000 hooks set in the Gulf of Mexico, 1979, are shown in Figure 13. Fishing activity in the Gulf of Mexico was distributed in the general area 25°-29° north latitude, 88°-94° west longitude. Within these boundaries, most of the fishing activity was concentrated near 25°-28° north latitude, 88°-92° west longitude. More than 77% of the total hooks were set in this area. A small amount of fishing activity was loated approximately 27°-29° north latitude, 86°-87° west longitude.

A geographical plot of fishing effort for the Gulf of Mexico, l980, is shown in Figure 14. The distribution patterns for approximately 1,830,000 hooks set in the Gulf of Mexico during 1980 indicate most fishing activity was located in the general area 24°-26° north latitude, 83°-84° west longitude. More than 68% of the total hooks were set in this area. Less fishing activity was located 25°-28° north latitude, 89°-94° west longitude. Major fishing activity shifted eastward from 88°-92° west longitude positions in 1979 to 83°-84° west longitude positions in 1980.

A combined plot of fishing effort for over 5,371,000 hooks set in the Gulf of Mexico during 1979 and 1980 is shown in

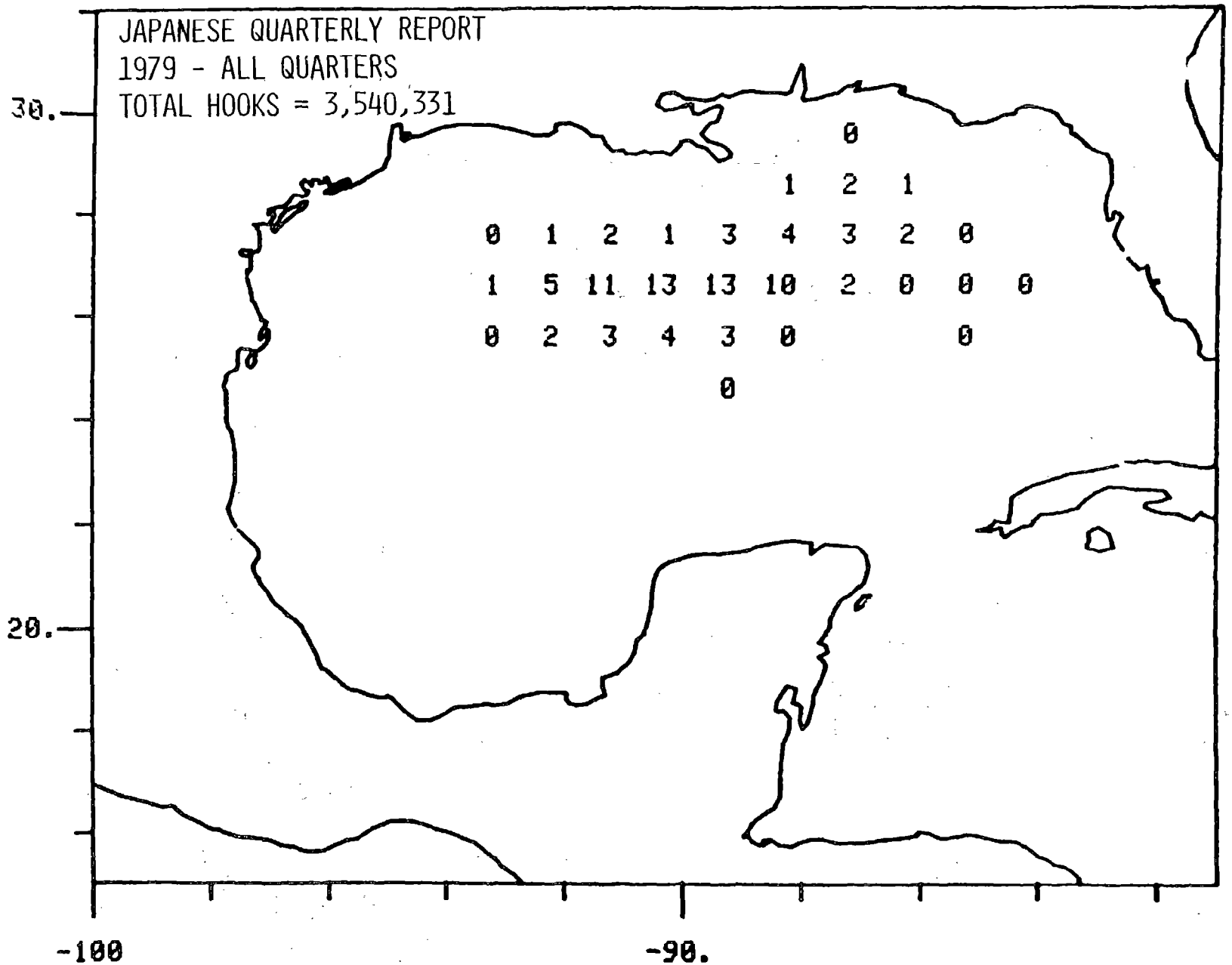

Figure 13. Truncated percentages of total hooks (Japanese Quarterly Reports), Gulf of Mexico - 1979

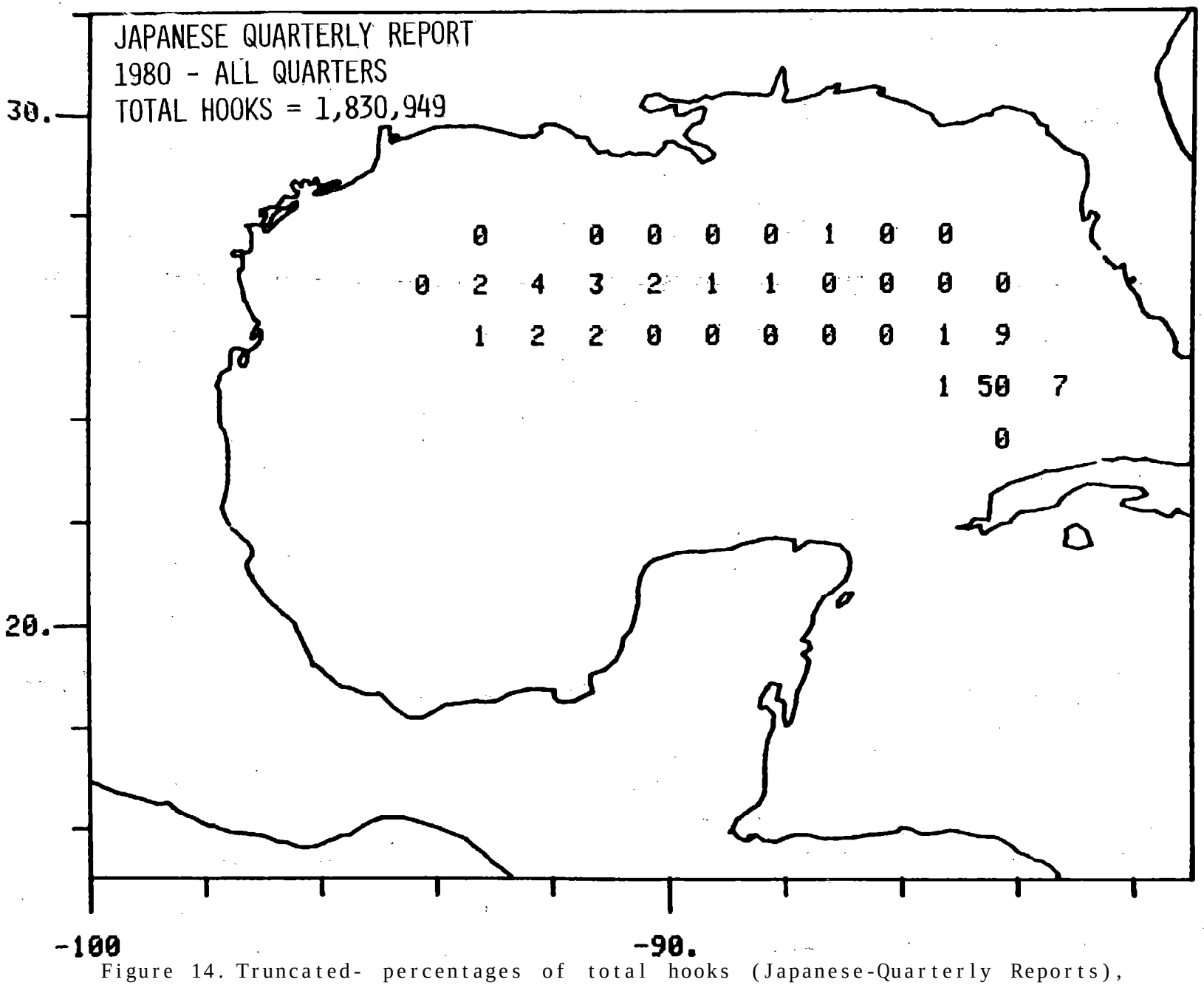

Figure 14. Truncated- percentages of total hooks (Japanese-Quarterly Reports), Gulf of Mexico - 1980

Figure 15. Fishing distribution patterns during the two-year period indicate that most of the hooks were set in the general area 25°-29° north latitude, 86°-94° west longitude. More than 67% of the total hooks were distributed throughout this area. A secondary fishing area was located approximately 25°-26° north latitude, 83°-84° west longitude.

5.2 CATCH RATES - TOTAL BILLFISH

Geographical plots of maximum mean catch rates for total billfish caught by Japanese longlines in the Atlantic and Gulf of Mexico, 1979 and 1980 were computed from observer Japanese Quarterly Statistical Report data. Percent maximum mean catch rates were computed by accumulating catch rates by 1° square, computing a mean catch rate for each square based on the accumulated values, selecting the maximum mean catch rate determined from all of the squares for the respective time period and area, and dividing each of the square mean catch rates by the maximum mean catch rate. The quotient was multiplied by 100 to express as a percentage, i.e.,

$$\bar{c}_i = \sum_{j=1}^{n_i} c_{ij}/n_i; \text{ and}$$

$$C_i = \bar{c}_1 (100)/\bar{c}\,\text{max} \qquad (10)$$

where $\bar{c}_i$ = the mean catch rate accumulated in a square,

C_1 = the truncated percentage of the maximum catch rate for the i-th square,

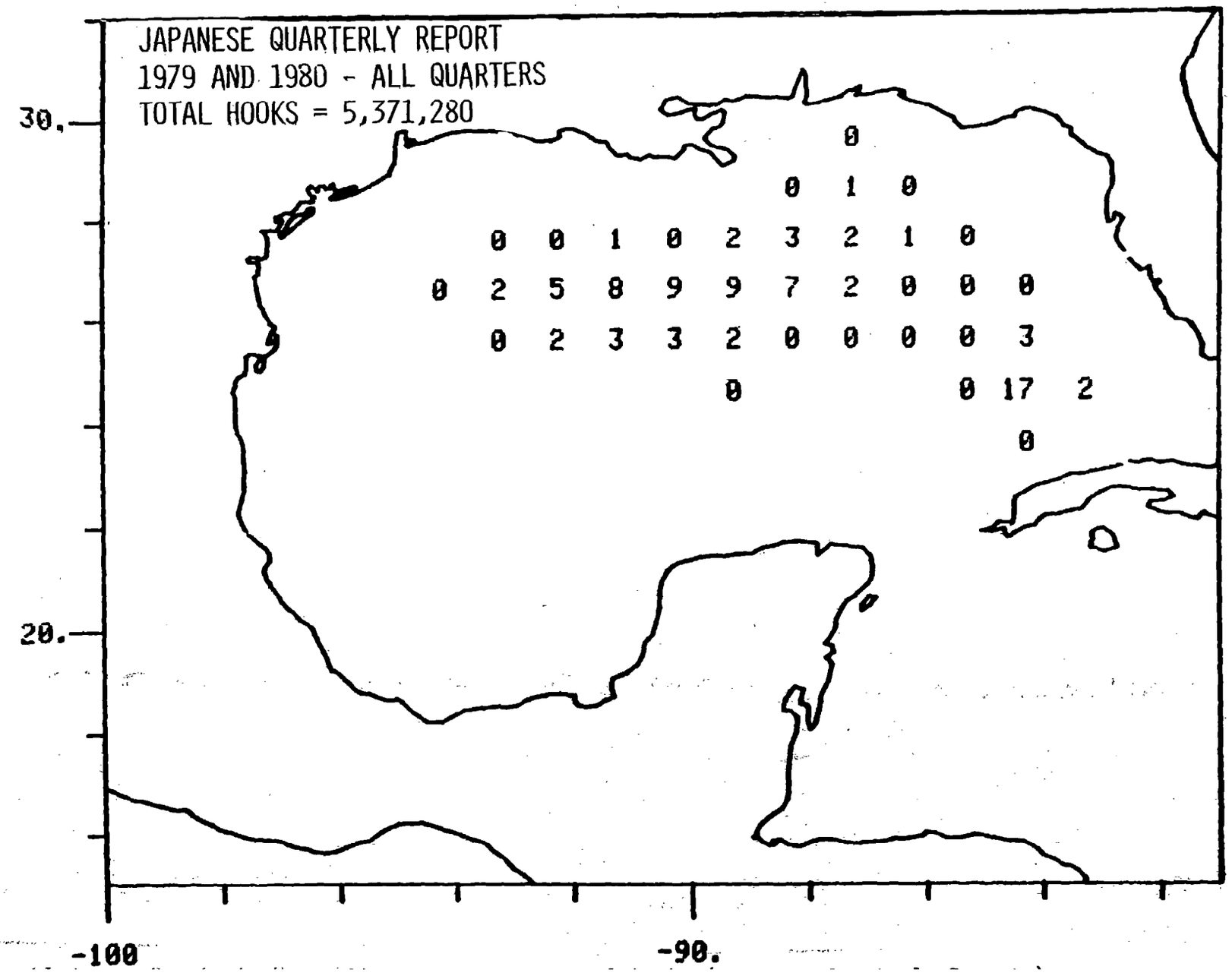

Figure 15. Truncated percentages of total hooks (Japanese Quarterly Reports), Gulf of Mexico - 1979-1980

$\bar{c}_{max}$ = the maximum mean catch rate reported for all squares (for the respective time period and area),

j = refers to the specific vessel or longline set depending on source data, and

n = the number of catch rates reported for a given square.

Geographical plots of mean maximum catch rate percentages for single and combined year (1979 and 1980) billfish catch rate percentages are given in Appendix E. Total catch rate percentage plots of individual billfish species also are included (Appendix F).

5.2.1 ATLANTIC

Billfish maximum mean catch rate percentages computed from observer data are geographically plotted for the Atlantic for 1979 and 1980 (Figures 16 and 17). Similar plots of data computed from Japanese Quarterly Statistical Reports are shown in Figures 18 and 19.

Distribution patterns of billfish catch rate percentages for 1979 show highest catch rate percentages located in offshore positions near 34°-40° north latitude, 65°-74° west longitude (Figure 16). The maximum catch rate during 1979 was 0.8148/100 hooks.

In 1980, the geographical plots of billfish catch rate percentages indicate the highest catch rate percentages were located in the area 28°-31° north latitude, 76°-78° west longitude (Figure 17). The maximum catch rate for 1980 was 0.8788/100 hooks. The 1980 distribution patterns represent a southeastern shift in location from the high catch rate locations of 1979, when highest catch rates were located in the

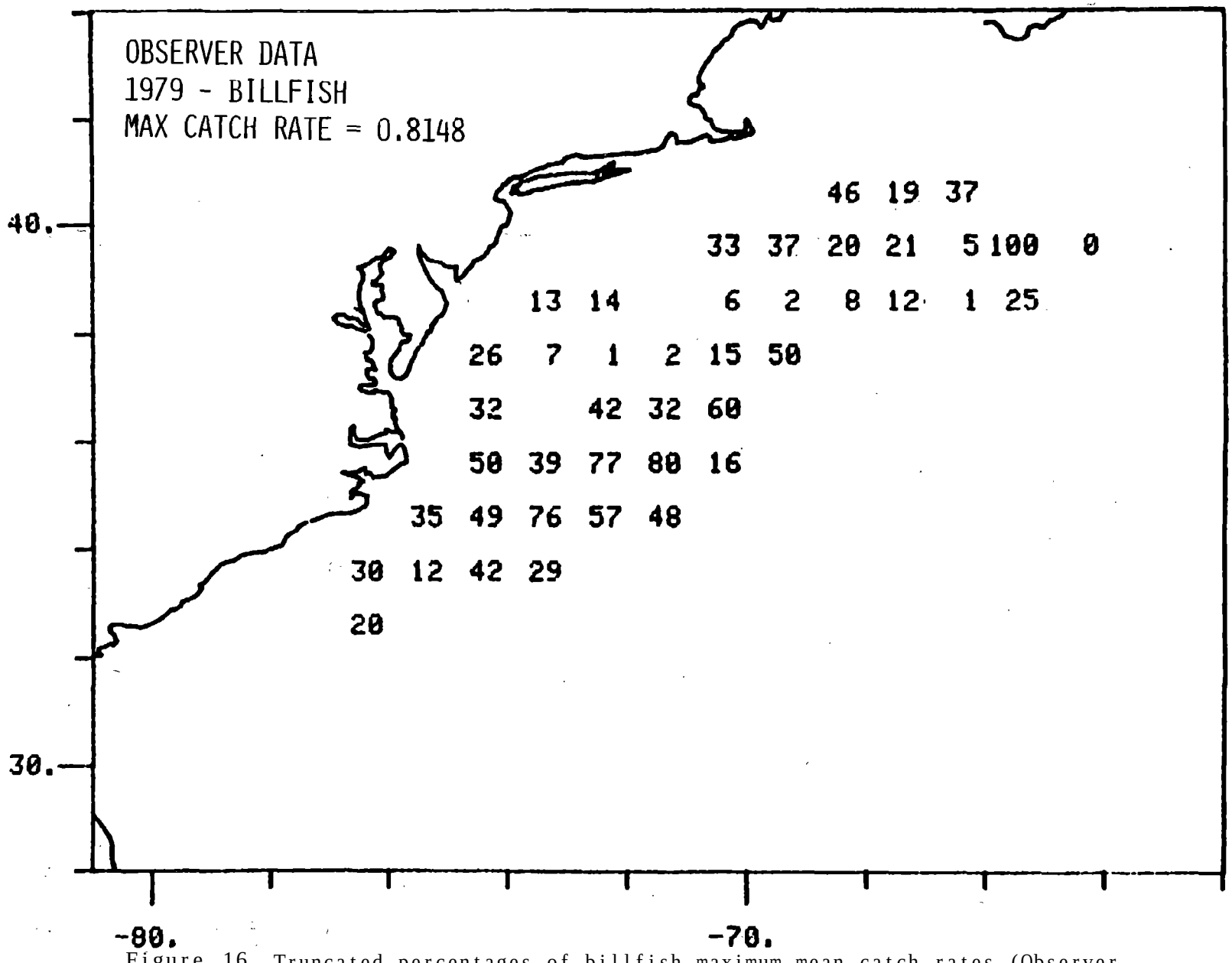

Figure 16. Truncated percentages of billfish maximum mean catch rates (Observer data), Atlantic - 1979

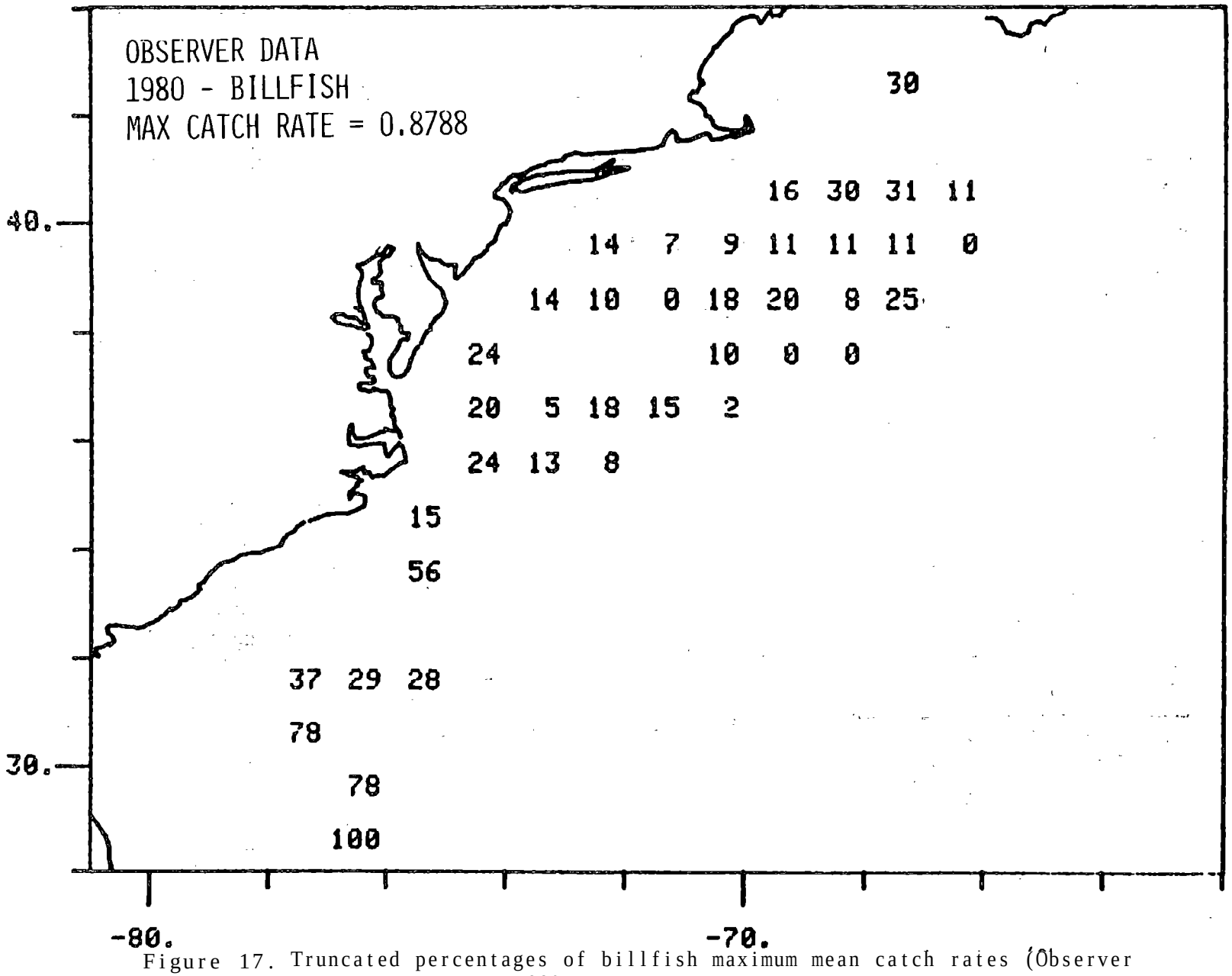

Figure 17. Truncated percentages of billfish maximum mean catch rates (Observer data), Atlantic - 1980

northeastern area of fishing activity.

Geographical plots of total billfish maximum mean catch rate percentages-computed from 1979 Japanese Quarterly Statistical Reports indicates the same general distribution of high catch rate areas noted from observer data (Figure 18). The highest catch rate locations were approximately 36°-40° north latitude, 70°-71° west longitude. A second area of relatively high catch rates was located approximately 38°-40° north latitude, 62°-64° west longitude. The maximum catch rate in 1979 was 0.7527/100 hooks.

Total billfish maximum mean catch rate percentages computed from Japanese report data in 1980 indicates highest catch rates occurred in the same general area as noted for the 1980 observer data (Figure 19). However, the high catch rate locations were spread over a more extensive area, 28°-38° north latitude, 74°-78° west longitude. The maximum catch rate/100 hooks for 1980 was 0.4167.

5.2.2 GULF OF MEXICO

The 1979 geographical plots of billfish catch rate percentages for the Gulf of Mexico are shown in Figure 20. The plots of high catch rate percentages are distributed throughout the area of fishing activity, ranges of 25°-28° north latitude, 86°-93° west longitude. Catch rates near the maximum catch rate (0.1444) werelocated approximately 25°-27° north latitude, 90°-93° west longitude.

The data plots for 1980 indicate high catch rate percentages were located in two general areas, 25°-28° north latitude, 90°-94° west longitude and 25°-26° north latitude, 86°-88° west longitude (Figure 21). The maximum billfish catch rate for 1980 was 0.5455/100

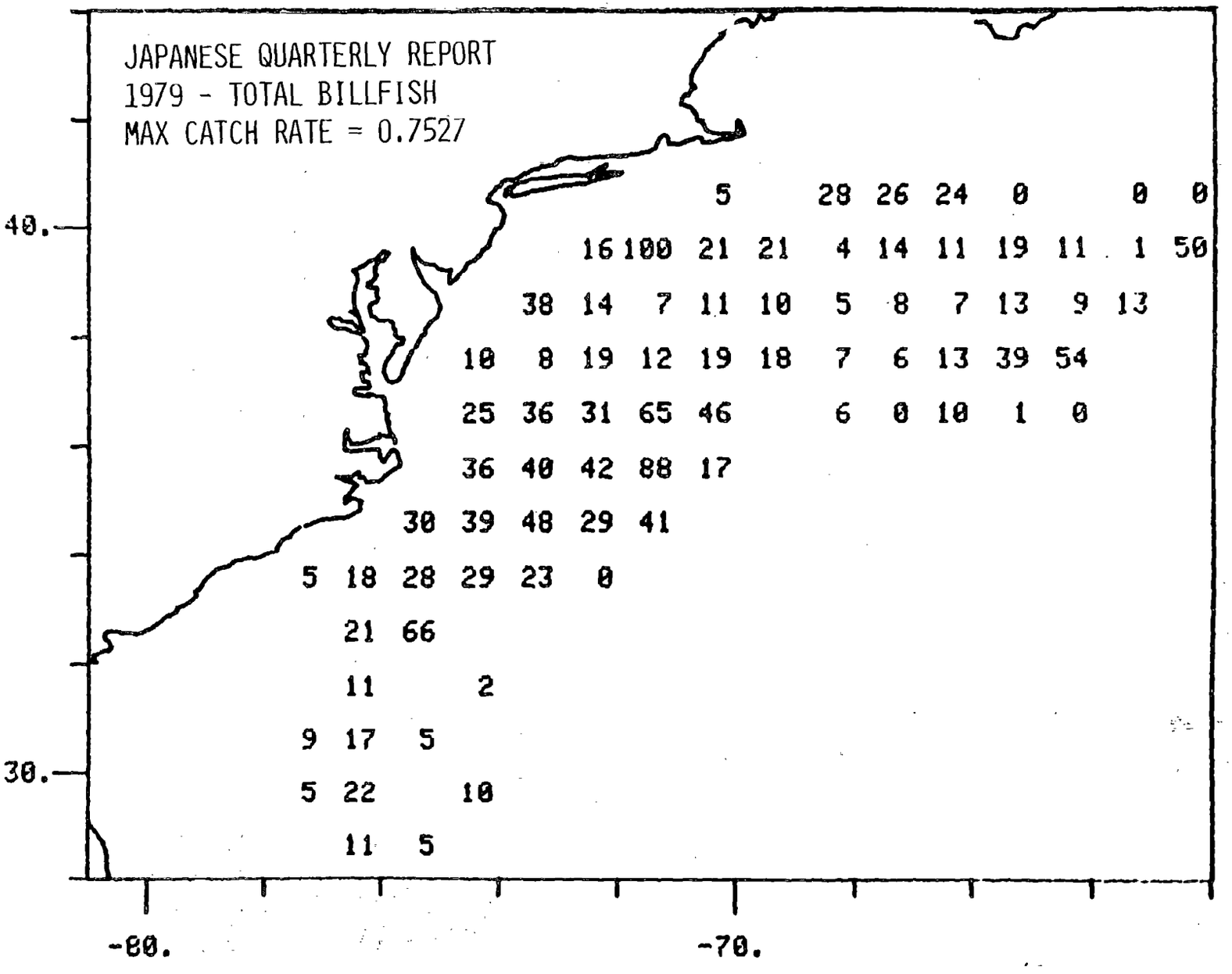

Figure 18. Truncated percentages of billfish maximum mean catch rates (Japanese Quarterly Reports), Atlantic - 1979

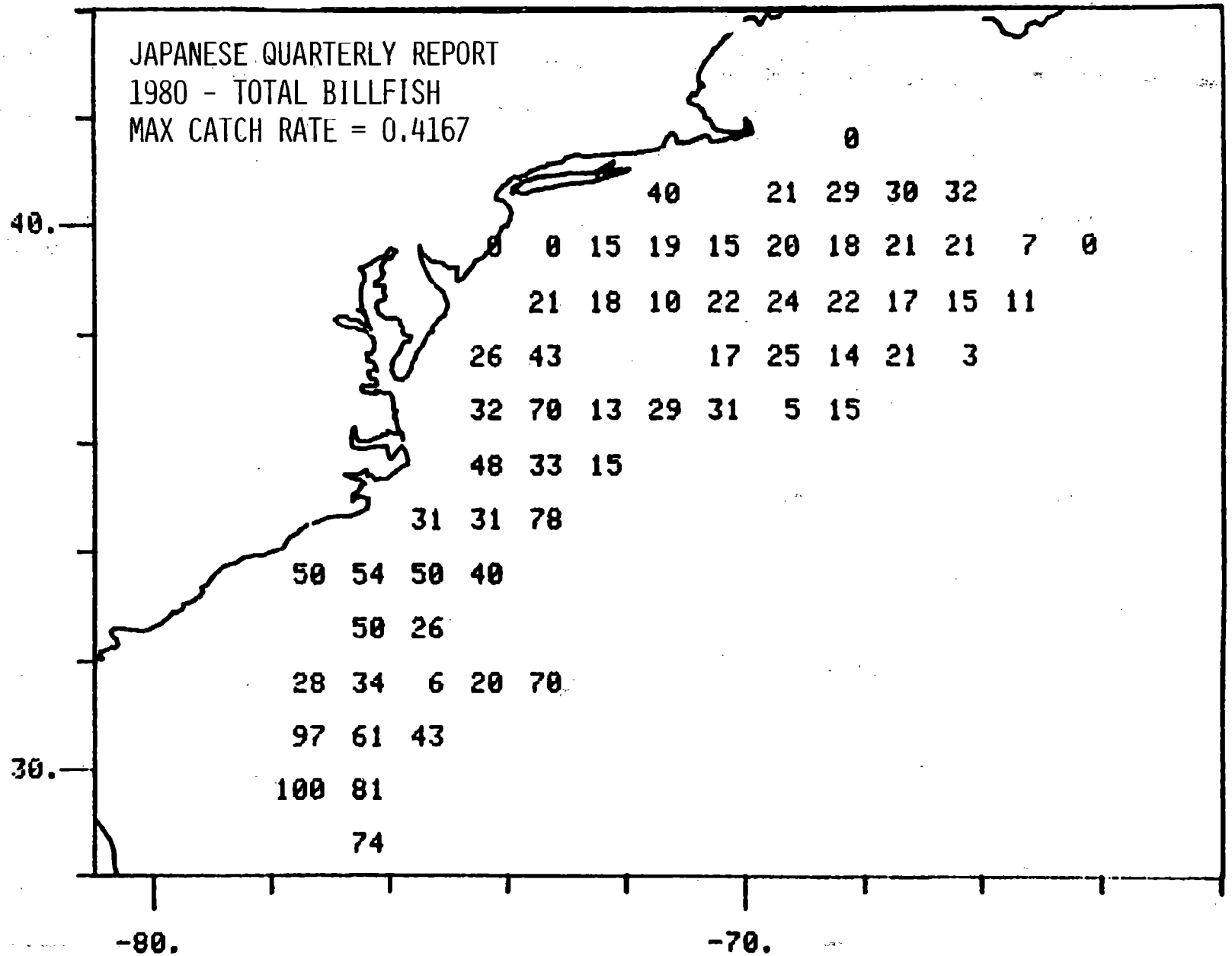

Figure 19. Truncated percentages of billfish maximum mean catch rates (Japanese Quarterly Reports), Atlantic - 1980

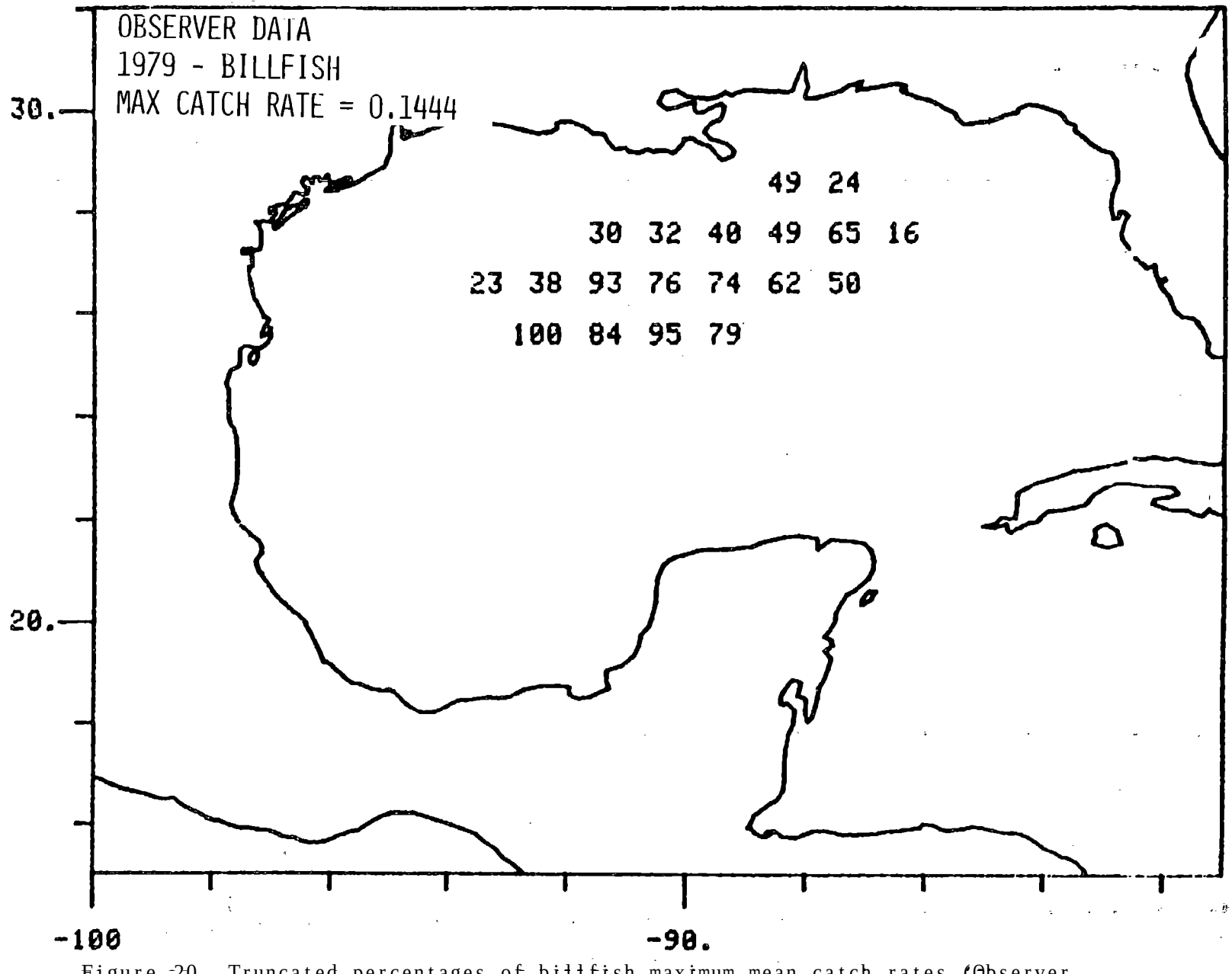

Figure 20. Truncated percentages of billfish maximum mean catch rates (Observer data), Gulf of Mexico - 1979

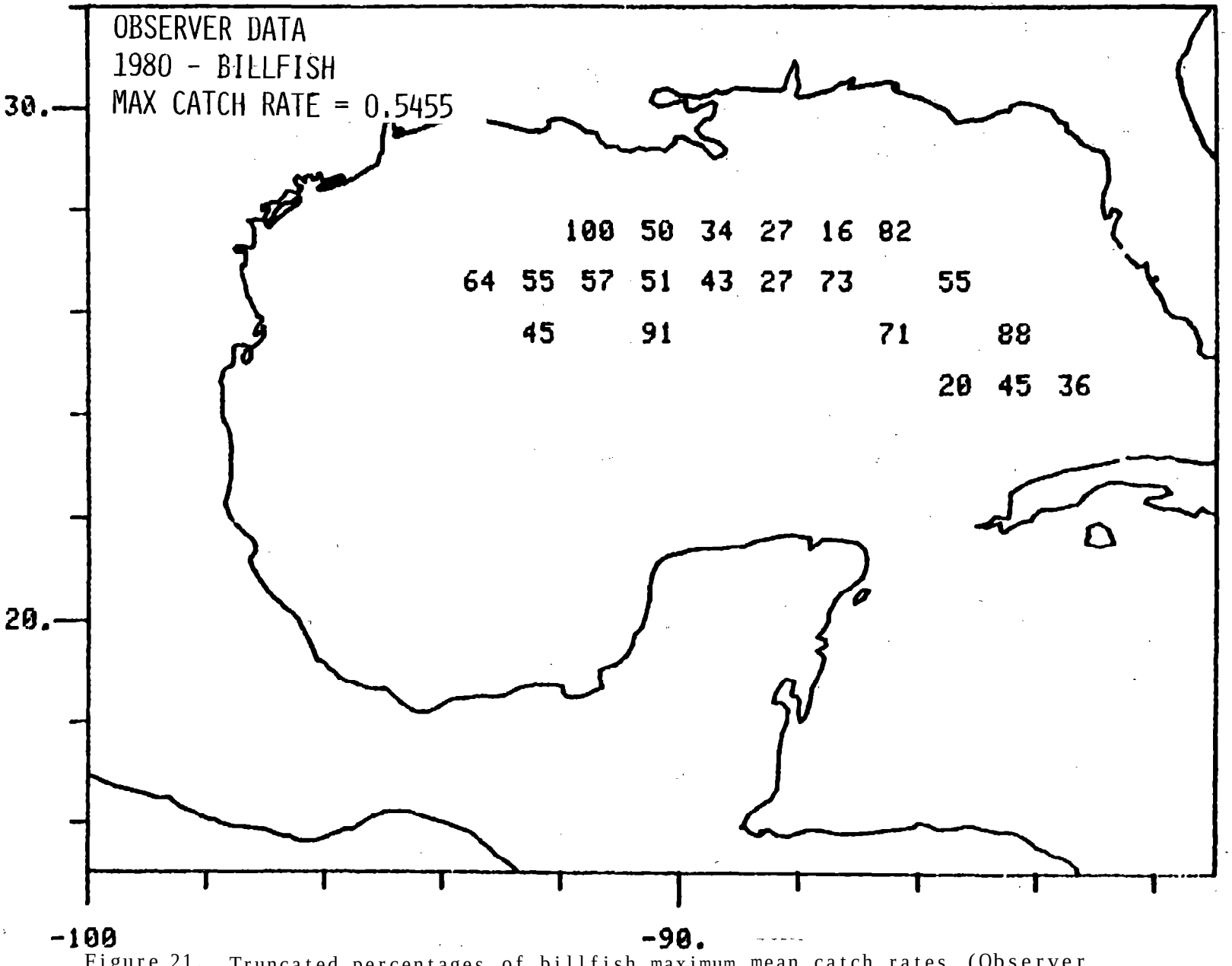

Figure 21. Truncated percentages of billfish maximum mean catch rates (Observer data), Gulf of Mexico - 1980

hooks.

Total billfish maximum mean catch rate percentages computed from Japanese Quarterly Statistical Reports for the Gulf of Mexico, 1979 are shown in Figure 22. Highest catch rate percentages were located approximately 25°-28° north latitude, 90°-94° west longitude. A second area with lower catch rate percentages is located near 26°-28° north latitude, 86°-88° west longitude. The maximum catch rate (0.1240/100 hooks) for total billfish in 1979 was located in the southeastern area of the fishing area.

Catch rate percentages for total billfish for 1980 are shown in Figure 23. Geographical plots of the catch rate percentages show that highest catch rates were 23°-26° north, 86°-88° west longitude. Lower catch rate percentages were distributed near 25°-26° north latitude, 89°-94° west longitude. The maximum catch rate (0.39531 100 hooks) for total billfish was located in the southeastern area of the area fished.

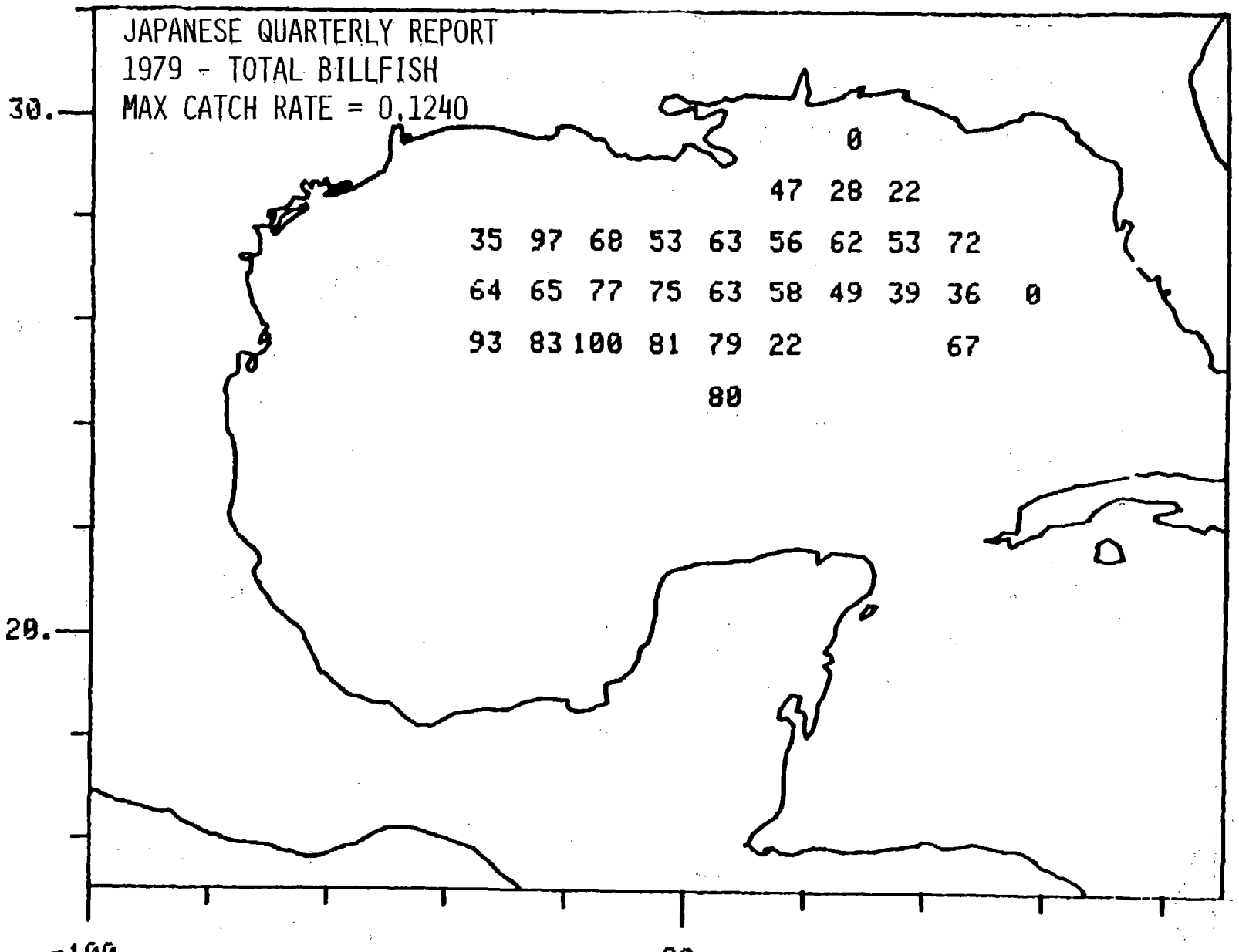

Figure 22. Truncated percentages of billfish maximum mean catch rates (Japanese Quarterly Report), Gulf of Mexico - 1979.

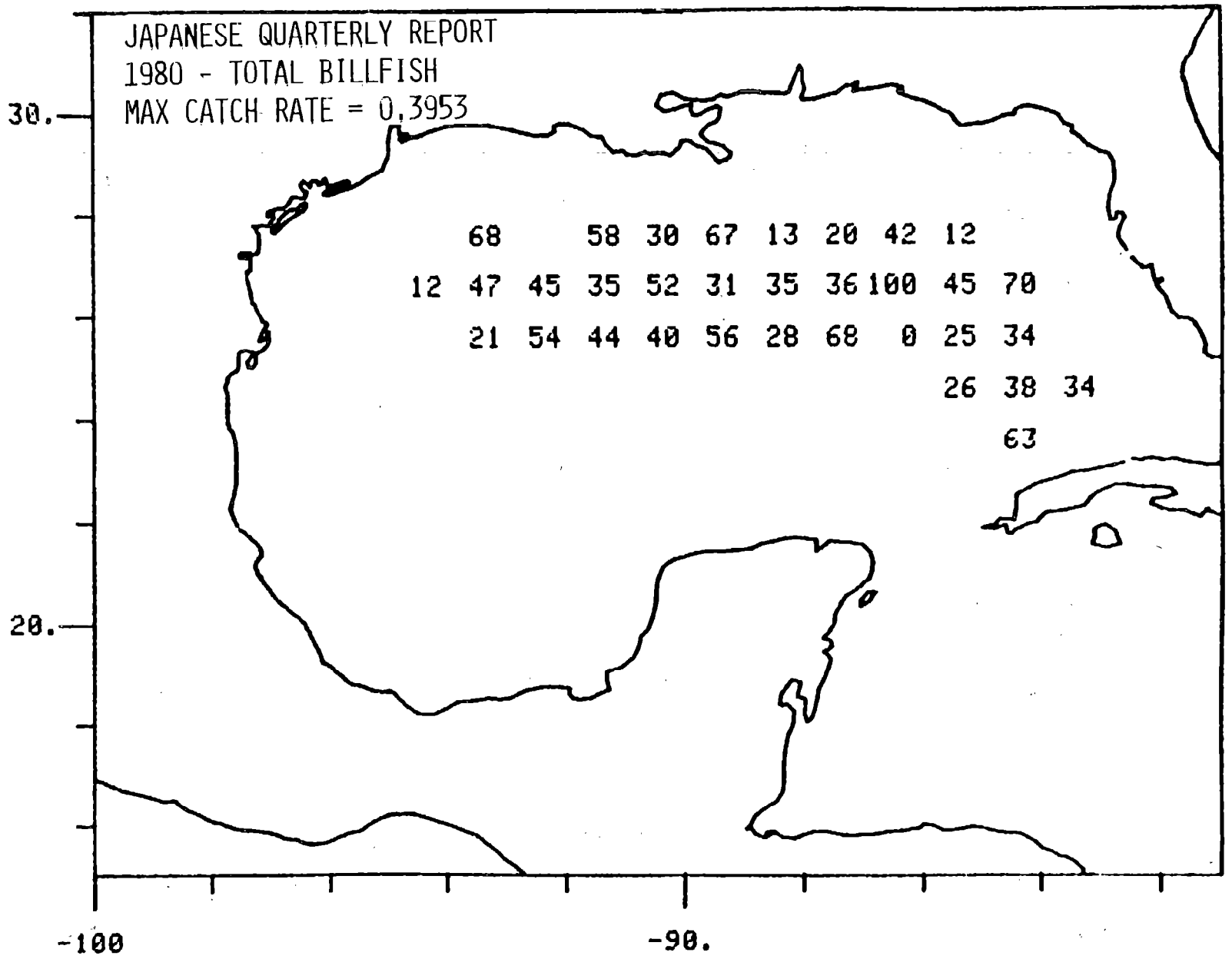

Figure 23. Truncated percentages of billfish maximum mean catch rates (Japanese Quarterly Report), Gulf of Mexico - 1980

SECTION 6.0

RECOMMENDATIONS

This technical report is the second report prepared in accordance with requirements set forth in the Foreign Fishery Observer Project Management Plan. The report is limited to data collected by foreign fishery observers and from the Japanese Quarterly Statistical Reports made to the SEFC.

The technical report on Japanese longline fishing in the Atlantic and Gulf of Mexico for 1979 was not available until February, 1982. Therefore, many of the recommendations made in the 1979 report were not acted upon, and these same problems were evident in the data analysis for the 1980 report.

6.1 OBSERVER COVERAGE

The Foreign Fishery Observer Project is required to maintain a level of coverage aboard foreign fishing vessels as dictated by research needs and MFCMA compliance functions on a regional and inter-regional basis. The problem of maintaining timely observer coverage aboard foreign vessels entering the FCZ remained a problem in 1980. Much of the scheduling and deployment problems were encountered through the complexity of communicating with foreign fleets entering the United States FCZ. Because observer deployment problems were similar to those experienced in 1979 the same recommendation is given again.

- Require that Japanese tuna vessels that intend to conduct fishing operations in the FCZ notify the Southeast Observer project through their U.S. shipping agent 14 days prior to commencing fishing activities.

6.2 JAPANESE REPORTS

In the Japanese Quarterly Statistical Report catch/effort data are summarized weekly by 1° squares. Observer catch/effort data are reported on a daily basis. The Japanese reporting method presents a serious problem when attempting to make statistical comparisons of catch rates from the two data sets. The reporting format for the Japanese reports virtually eliminates any possibility of deriving useful information on the variance associated with their catch rates. It also makes it difficult to determine whether a set occurred in or outside the FCZ. These problems were mentioned previously in the 1979 report and continued to present analytical problems for the 1980 data.

If the Japanese were required to record sets, catch and numbers of hooks on a daily basis, most of the problems could be eliminated.

Recommendations for eliminating data problems are the same as those recommended in 1979, namely:

- The Japanese should be required to report catch by set on daily basis, record exact numbers of hooks used in each set and provide exact positions (latitude and longitude) for start and end of the haulback.
- The Japanese should record species information individually instead of lumping catches into broad species categories and record all species caught including the tunas.

6.3 ENFORCEMENT MANAGEMENT INFORMATION SYSTEM (EMIS)

As was shown throughout Table 1 of this report, there appears to be many discrepancies between EMIS reported days for foreign vessels in the FCZ and those reported in the Japanese Quarterly Statistical Reports during 1980. The 1979 technical report indicated there appeared to be discrepancies in the Japanese daily vessel activity and movement reports transmitted to the U.S. Coast Guard-and those subsequently recorded in EMIS (Thompson, 1982). Based on the discrepancies noted for both reports, the same recommendation is again presented:

o NMFS enforcement and Coast Guard personnel should monitor EMIS on a regular basis and compare Japanese Quarterly Report vessel movements quarterly to locate vessels which do not report accurate vessel movements within the FCZ.

Literature Cited

Sokal, R.R. and Rohlf, F.J., 1969. Biometry, the principles and practice of statistics in biological research, pp. 607 to 610. Copyright 1969 by W.H. Freeman and Company.

Thompson, Perry A., Jr., 1982. Japanese longline fishing: comparison between observer data and Japanese quarterly reports for 1979 in the Atlantic and Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFC-64.

_____December 1981. Geographical plots of Japanese tuna longline fishing activities in 1979 and 1980 (an internal report). NOAA, NMFS, Southeast Fisheries Center, Mississippi Laboratories, Pascagoula Facility.

Acknowledgements

The author expresses thanks to Dr. Andrew J. Kemmerer for his help with the organization, statistics and review of this report. Shelby Drummond for his advice, patience and support during the writing of this report, Perry Thompson for his helpful suggestions and review; Sam Burkett and Margie Bastion for software development; and Diane Hill for typing and technical advice. Very special thanks to Sally Glynn whose typing skills and timeliness made this report much easier to complete.

PASCAGOULA LABORATORY SURFACE LONGLINE OBSERVER FORM

VESSEL NAME: ______________________

CAPTAIN'S NAME: ______________________

OBSERVER: ______________________

1 VESSEL | 3 MONTH DAY YEAR | 9 SET | 10 PERMIT NUMBER

START SET 18 LATITUDE LONGITUDE | 26 TIME | 28 VES. SPD | 30 DIRECTION

END SET 33 LATITUDE LONGITUDE | 41 TIME | 43 TARGET | 45 BAIT

47 GANGION LENGTH | 49 FLOATLINE LENGTH | 52 LENGTH FLOAT-FLOAT | 55 NO. OF HOOKS | 59 NO. OF FLTS.

START HAUL 62 LATITUDE LONGITUDE | 70 TIME | 72 VES. SPD | 74 DIRECTION | 77 ZONE

END HAUL 10 LATITUDE LONGITUDE | 18 TIME | 20 OBSVR. | 22 CAPTAIN

WATER TEMP. 24 START SET | 27 END SET | 30 START HAUL | 33 END HAUL

ENVIRO. RECORD AT NOON 36 WIND DIRECT. | 39 WIND SPD. | 41 WAVE DIRECT. | 44 Hk. Bt. Ft. | 46 WAVE HT.

48 AIR TEMP. | 51 BAROMETRIC PRESS. | 56 Δ | 57 TOTAL CATCH NO.

TUNA NO. | SHARKS NO. | BILLFISH NO. | OTHER NO.

COMMENTS:	GEAR DIAGRAM
	SET
	HAULBACK

VESSEL	MONTH	DAY	YEAR	SET	ZONE
1	3			9	77

SPEC. CODE	WEIGHT (kg)	WT. CODE	LENGTH (cm)	LEN. CODE	SP. STAT	TAG NUMBER	SAMPLE NUMBER	WATER TEMP.	SEX	GIRTH (cm)	HOOK NO.	TIME	COMM. CODE
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
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	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	.		.					.					
	12	16	17	21	22	23	30	41	44	47	51	52	56

QUARTERLY STATISTICAL REPORT (1979)
CATCH AND EFFORT DATA REQUIRED BY FOREIGN FISHING REGULATION
611.60(g) (i)

VESSEL NAME: ___________ MARU NO. ___________ PERMIT NUMBER: ________________

DURATION	AREA 1° SQ		NO. OF HOOKS	NUMBER OF FISHES (BY SPECIES CODE)																					
				252		260		256		264		254		469		299		236		240		244			
	LAT (N)	LON (W)		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
FROM																									
TO																									
FROM																									
TO																									
FROM																									
TO																									
FROM																									
TO																									
FROM																									
TO																									
FROM																									
TO																									
FROM																									
TO																									

A: NUMBER OF FISHES CAUGHT AND RELEASED
B: NUMBER OF FISHES RELEASED ALIVE

Appendix C.

QUARTERLY STATISTICAL REPORT (1979)
VESSEL ACTIVITIES DATA REQUIRED BY FOREIGN FISHING REGULATION
611.60(g) (ii)

VESSEL NAME: __________ MARU NO: _______ PERMIT NUMBER: __________

DATE (G.M.T.)	NOON-DAY LOCATION		DATE (G.M.T.)	NOON-DAY LOCATION		DATE (G.M.T.)	NOON-DAY LOCATION	
	LAT. N	LONG. W		LAT. N	LONG. W		LAT. N	LONG. W

Appendix D

SCIENTIFIC NAMES

Blue Marlin	-	*Makaira nigricans*
White Marlin	-	*Tetrapturus albidus*
Sailfish	-	*Istiophorus albicans*
Spearfish	-	*Tetrapturus pfluegeri*
Swordfish	-	*Xiphias gladius*
Leatherback	-	*Dermochelys coriacea*
Loggerhead	-	*Caretta caretta*
Bottlenose Dolphin	-	*Tursiops truncatus*
False Killer Whale	-	*Pseudorca crassidens*
Green Turtle	-	*Chelonia mydas*

Appendix E

LIST OF FIGURES

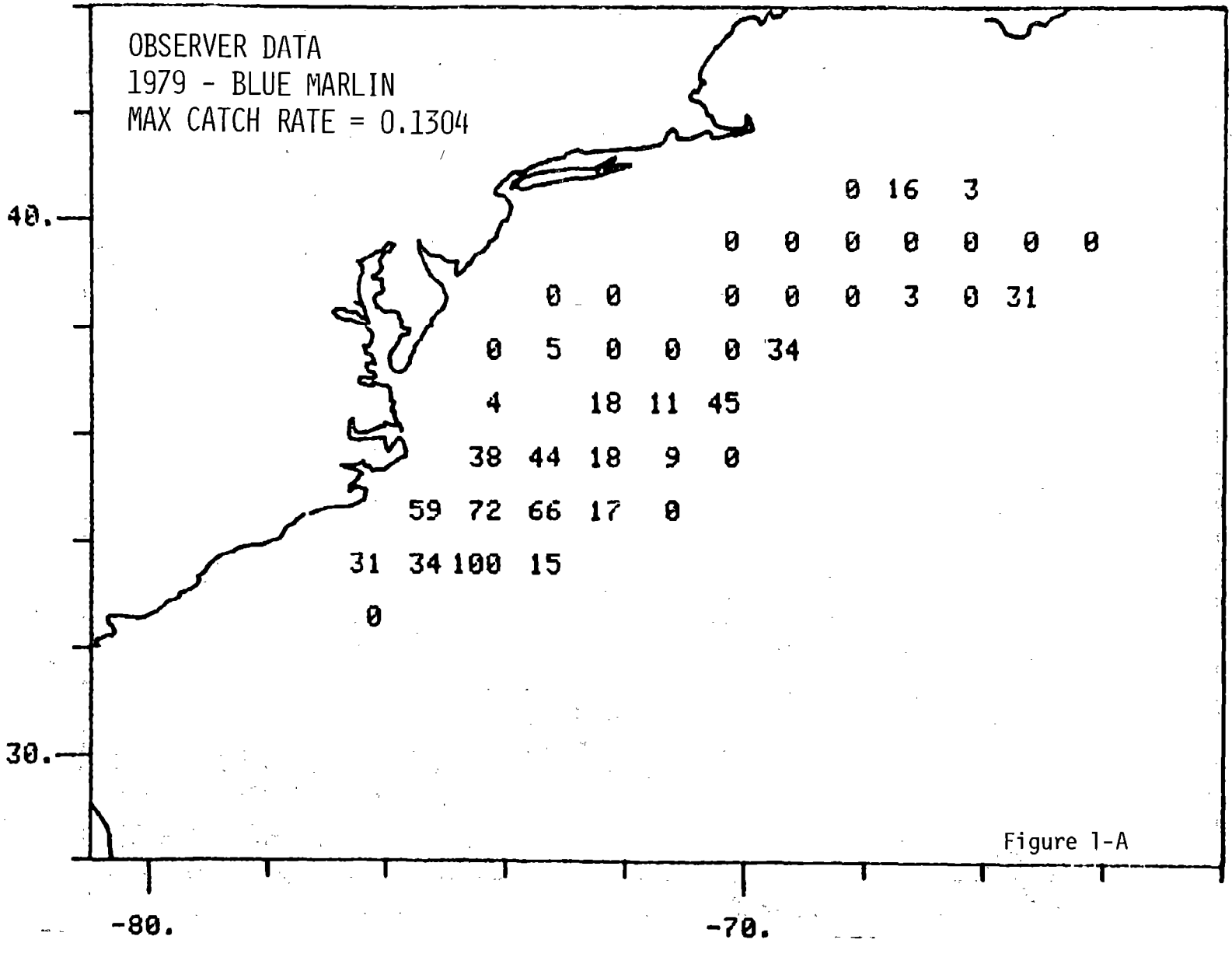
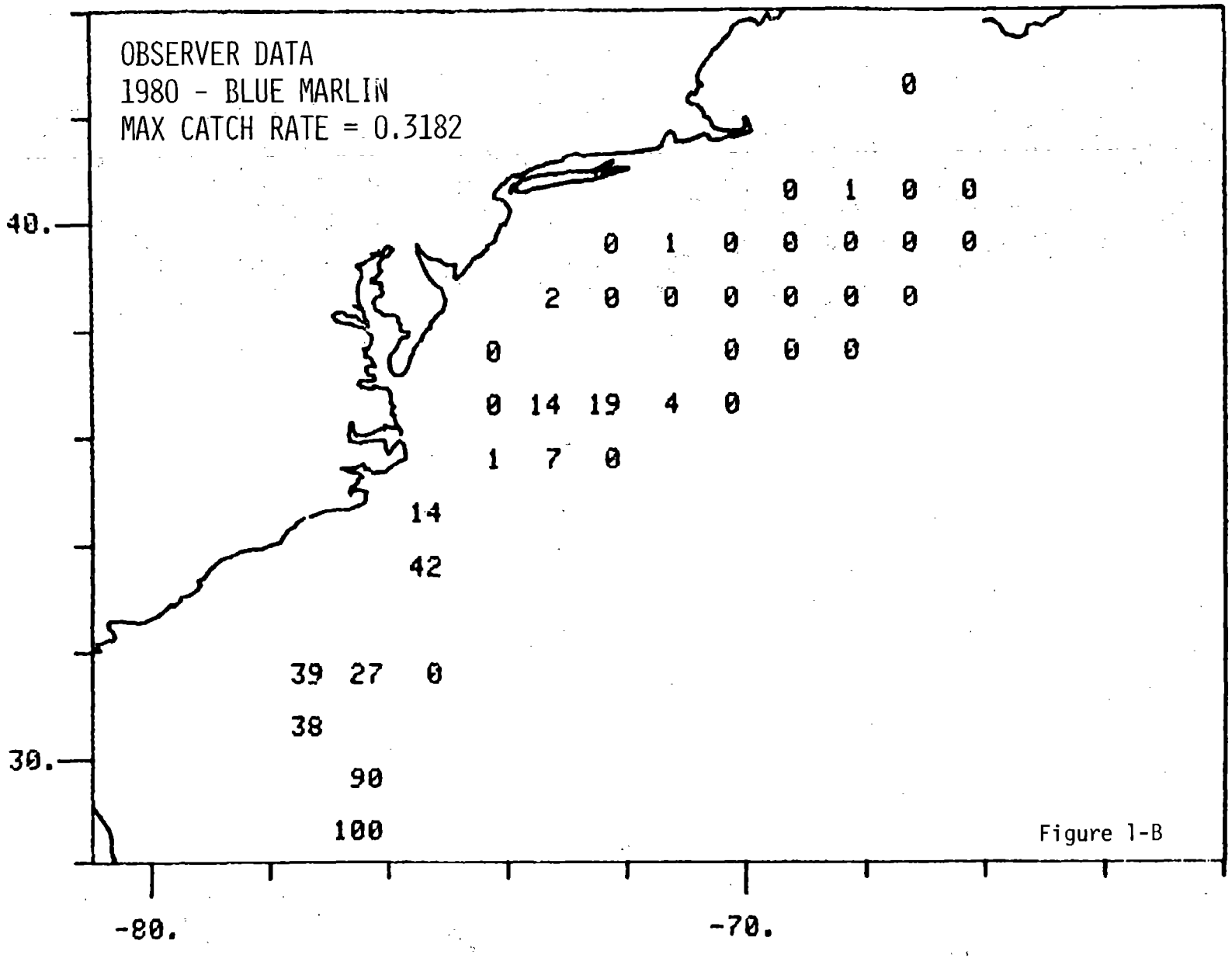

OBSERVER DATA
1979 - BLUE MARLIN
MAX CATCH RATE = 0.1304
40.
30.
-80.
-70.
0 16 3
0 0 0 0 0 0 0
0 0 0 0 0 3 0 31
0 5 0 0 0 34
4 18 11 45
38 44 18 9 0
59 72 66 17 0
31 34 100 15
0

Figure 1-A


OBSERVER DATA
1980 - BLUE MARLIN
MAX CATCH RATE = 0.3182
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30.
-80.
-70.
0
0 1 0 0
0 1 0 0 0 0 0
2 0 0 0 0 0 0
0 0 0 0
0 14 19 4 0
1 7 0
14
42
39 27 0
38
90
100

Figure 1-B

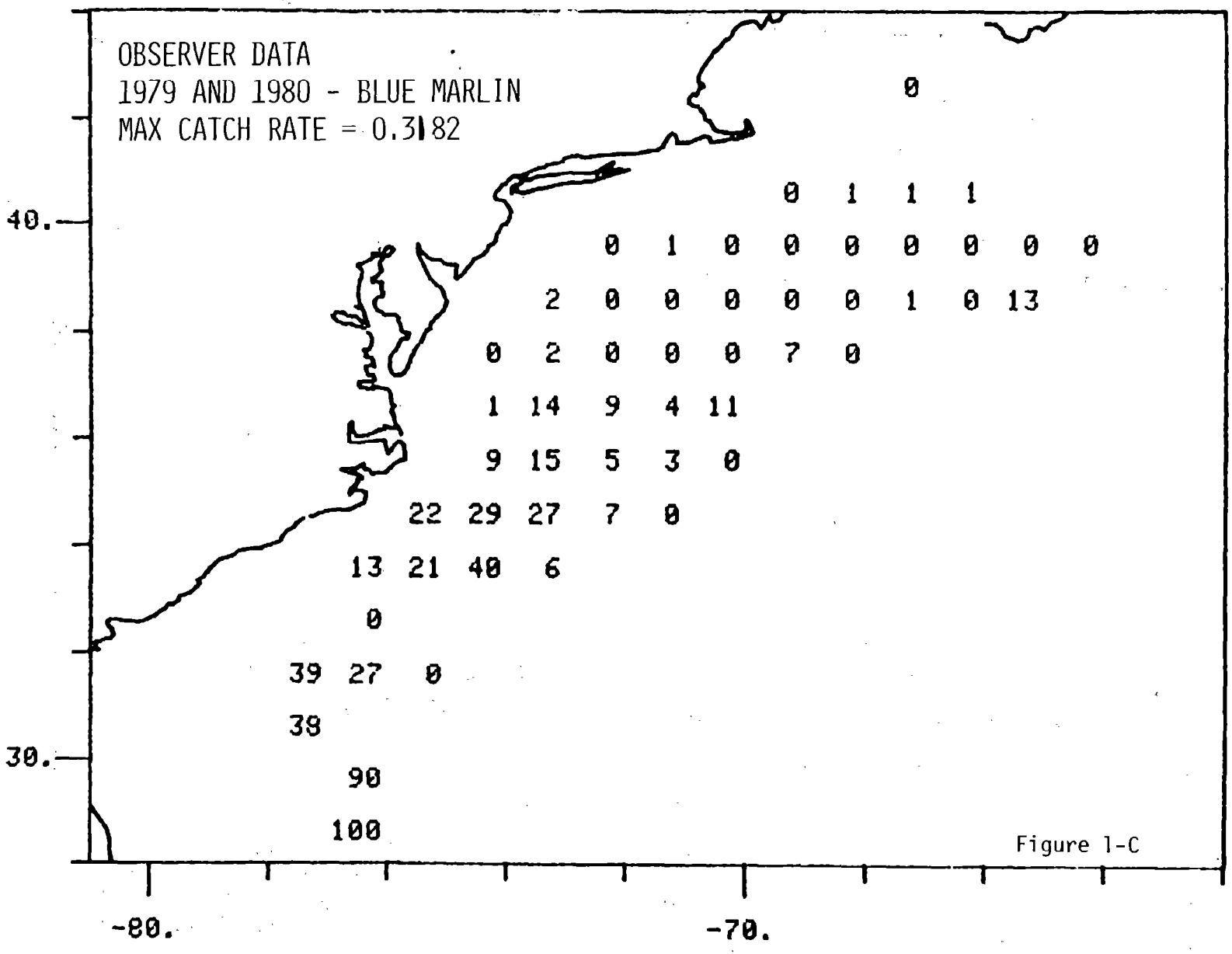
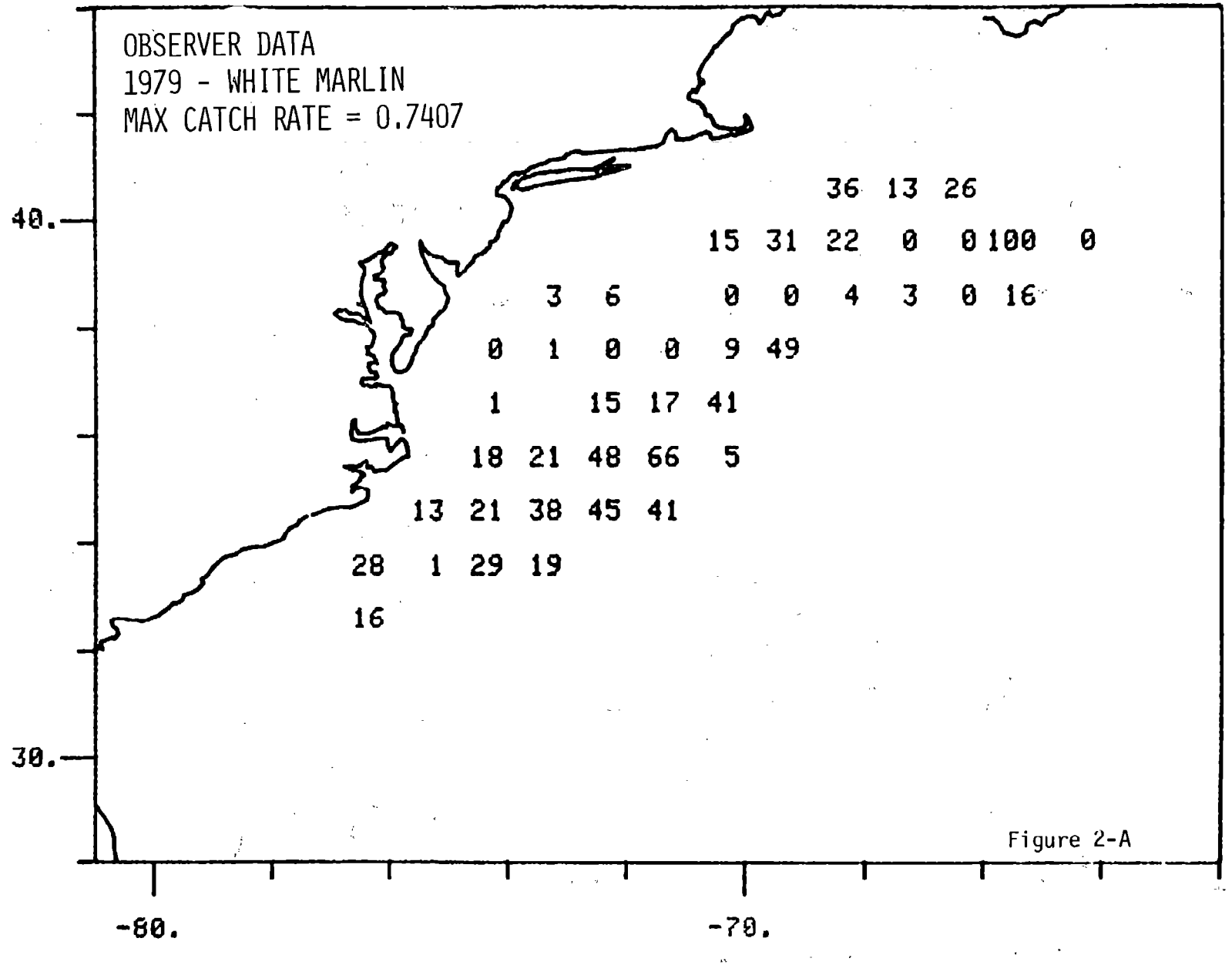

OBSERVER DATA
1979 AND 1980 - BLUE MARLIN
MAX CATCH RATE = 0.3182
40.
30.
-80.
-70.
0
0 1 1 1
0 1 0 0 0 0 0 0 0
2 0 0 0 0 0 1 0 13
0 2 0 0 0 7 0
1 14 9 4 11
9 15 5 3 0
22 29 27 7 0
13 21 40 6
0
39 27 0
38
90
100

Figure 1-C


OBSERVER DATA
1979 - WHITE MARLIN
MAX CATCH RATE = 0.7407
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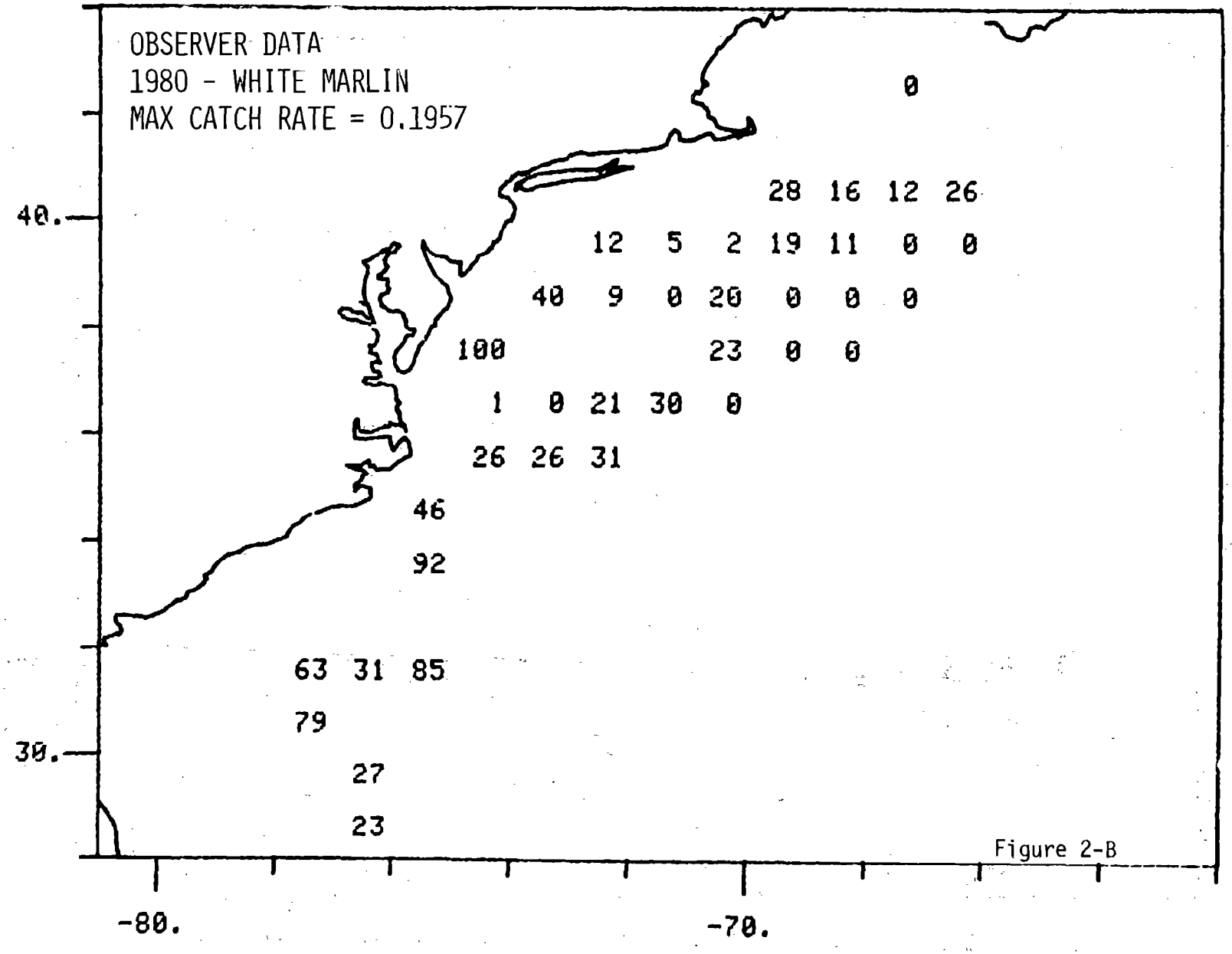
30.
-80.
-70.
36 13 26
15 31 22 0 0 100 0
3 6 0 0 4 3 0 16
0 1 0 0 9 49
1 15 17 41
18 21 48 66 5
13 21 38 45 41
28 1 29 19
16

Figure 2-A


OBSERVER DATA
1980 - WHITE MARLIN
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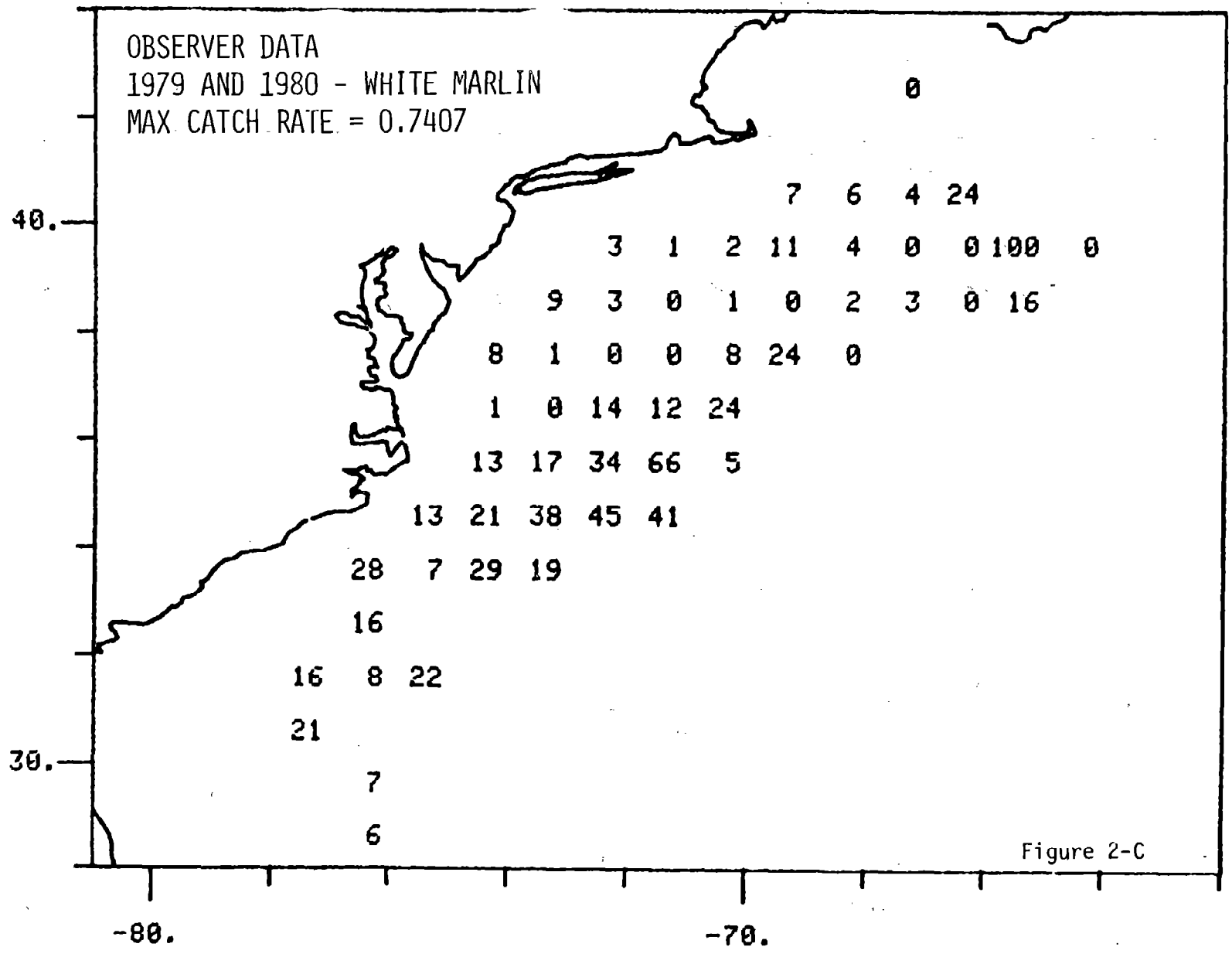
30.
-80.
-70.
0
28 16 12 26
12 5 2 19 11 0 0
40 9 0 20 0 0 0
100 23 0 0
1 0 21 30 0
26 26 31
46
92
63 31 85
79
27
23

Figure 2-B


OBSERVER DATA
1979 AND 1980 - WHITE MARLIN
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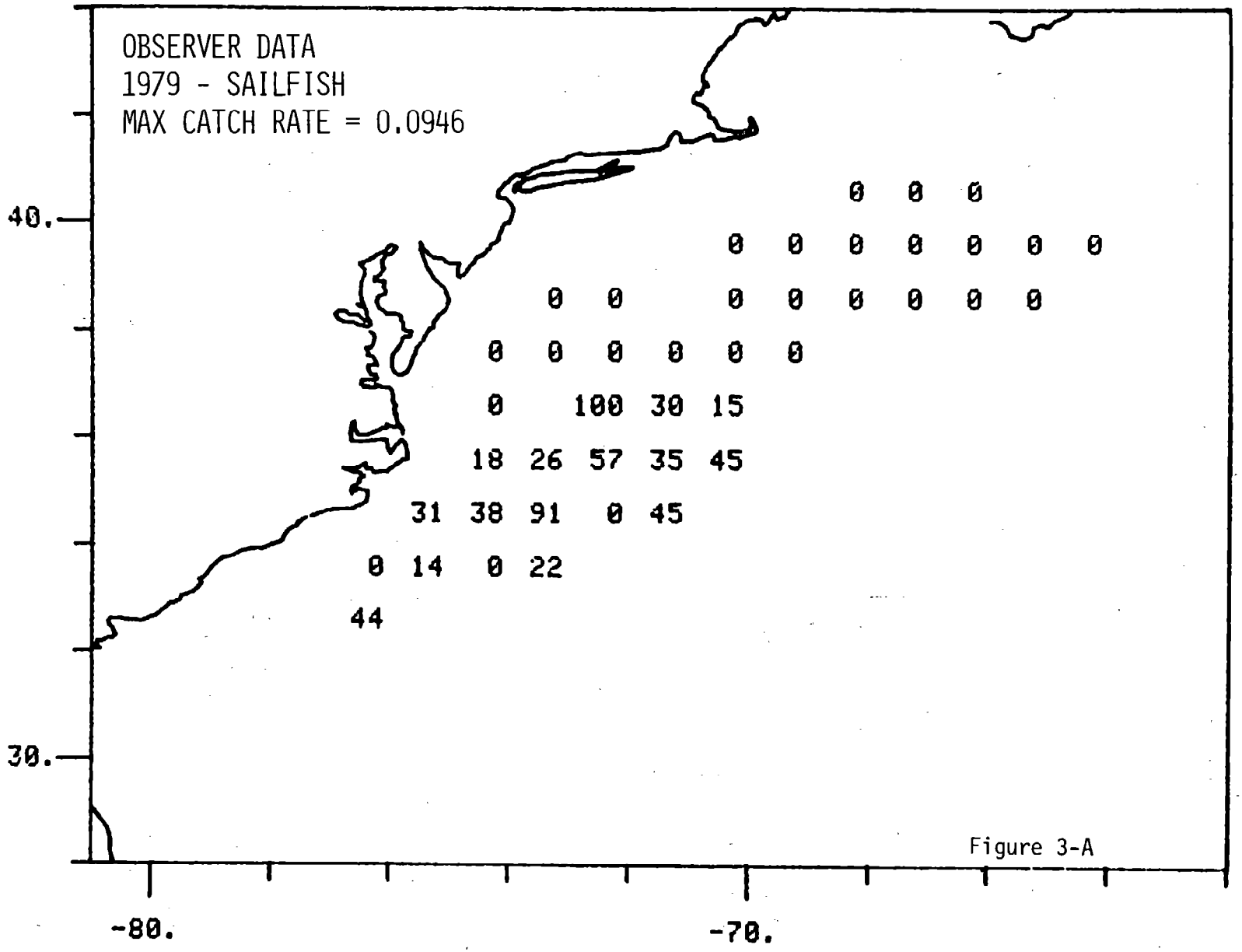
40.
30.
-80.
-70.
0
7 6 4 24
3 1 2 11 4 0 0 100 0
9 3 0 1 0 2 3 0 16
8 1 0 0 8 24 0
1 0 14 12 24
13 17 34 66 5
13 21 38 45 41
28 7 29 19
16
16 8 22
21
7
6

Figure 2-C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-70.
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0 0 0 0 0 0 0
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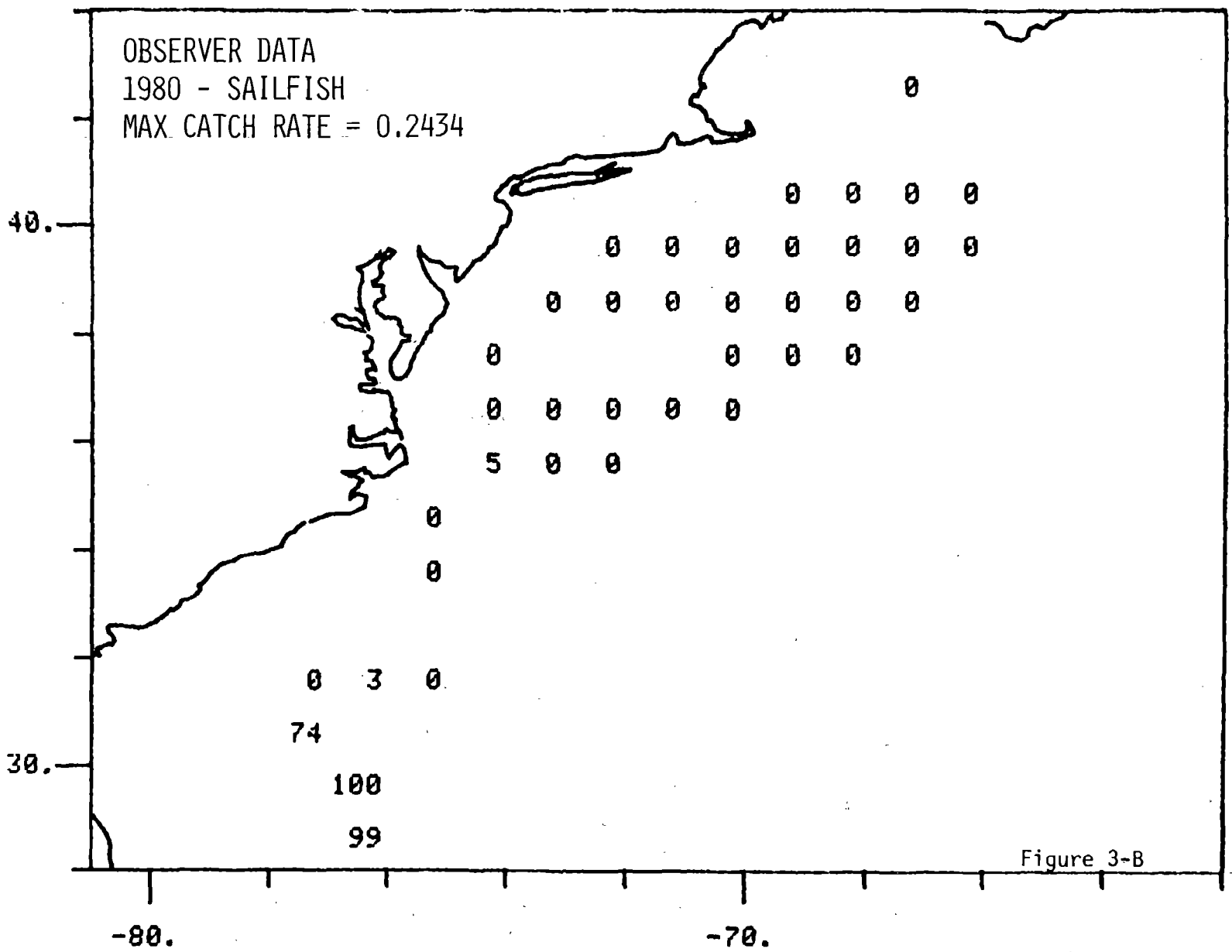
0 0 0 0 0 0
0 100 30 15
18 26 57 35 45
31 38 91 0 45
0 14 0 22
44

Figure 3-A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MAX CATCH RATE = 0.2434
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30.
-80.
-70.
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0 0 0 0 0 0 0
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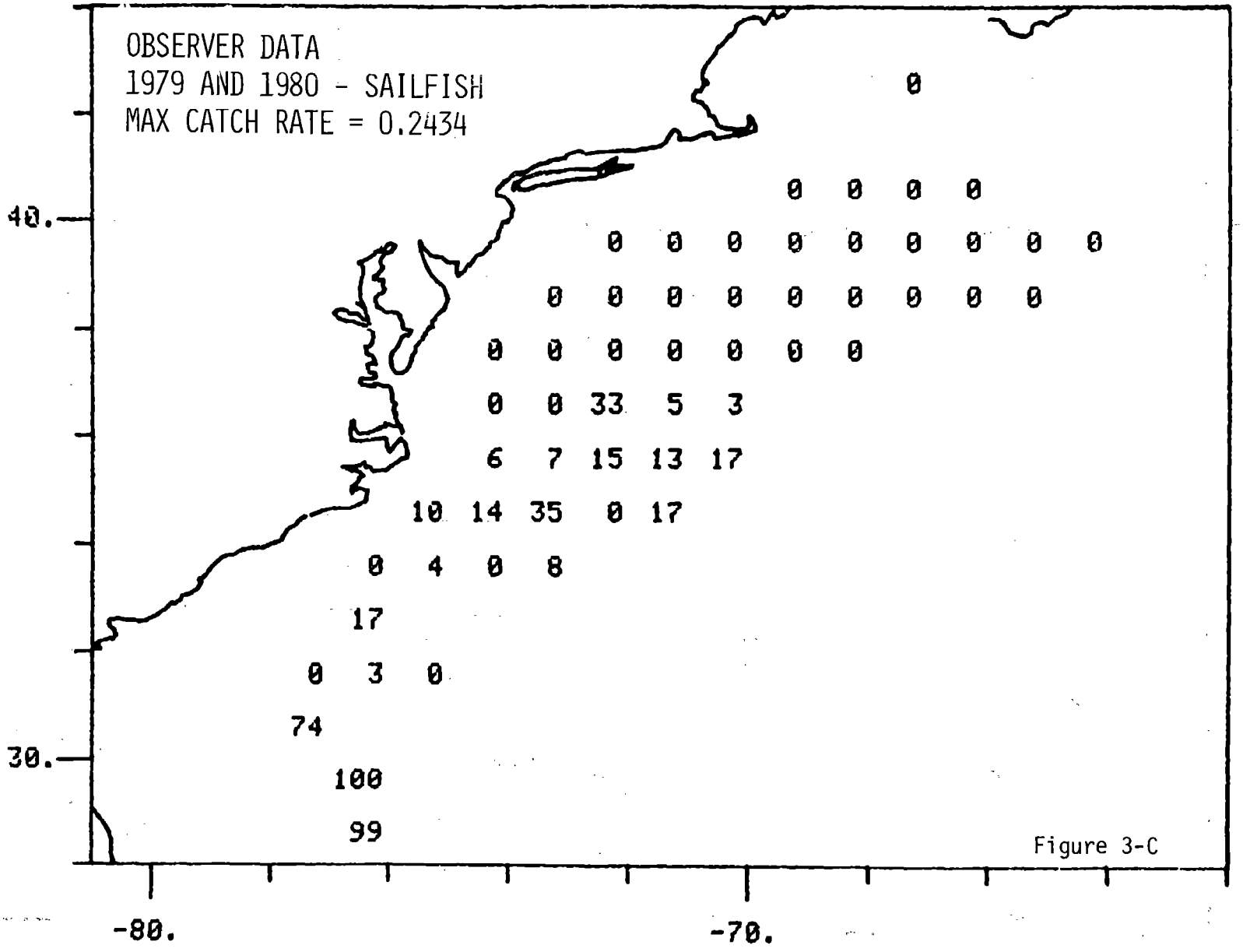
0
0
0 3 0
74
100
99

Figure 3-B


OBSERVER DATA
1979 AND 1980 - SAILFISH
MAX CATCH RATE = 0.2434
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30.
-80.
-70.
0
0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0
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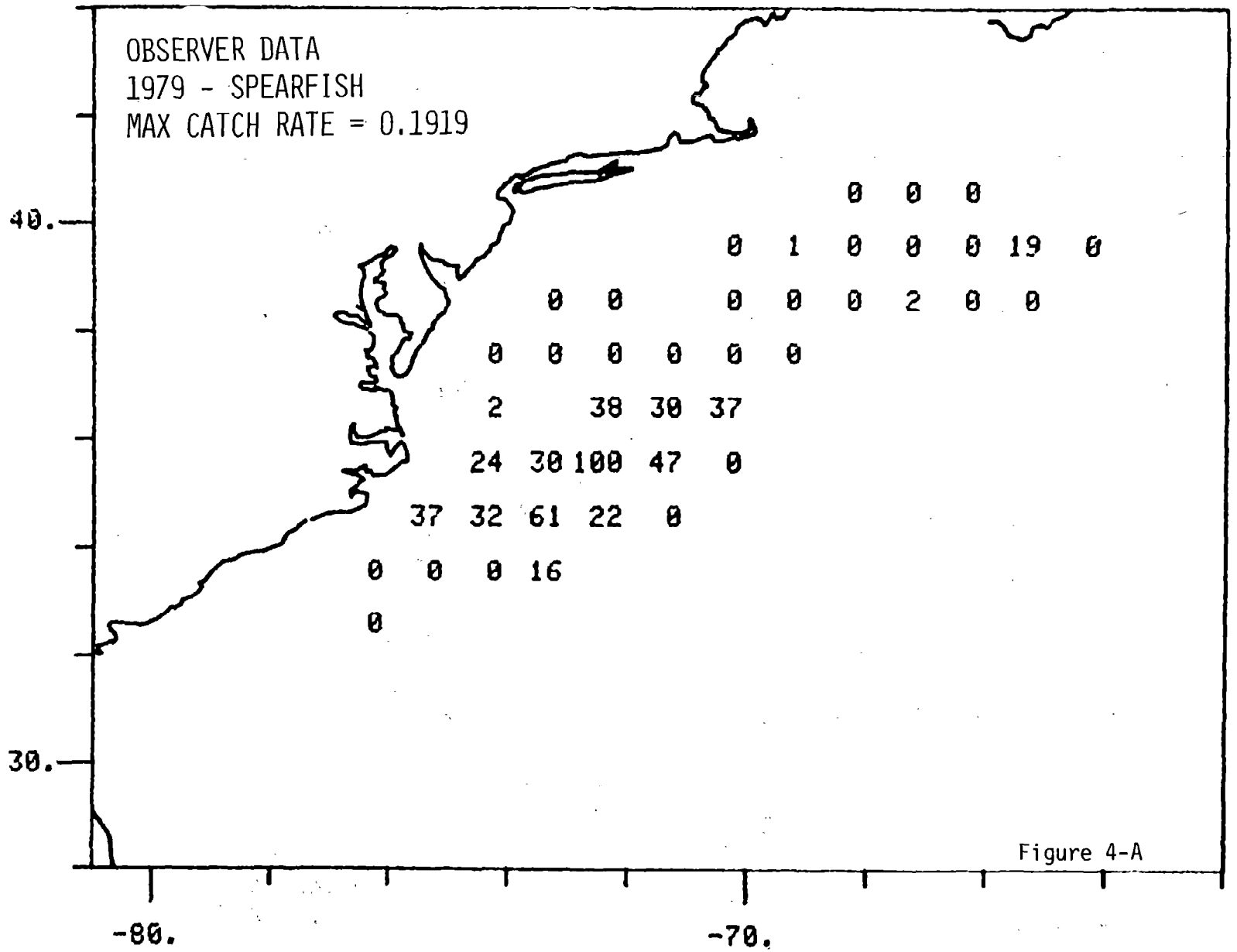
6 7 15 13 17
10 14 35 0 17
0 4 0 8
17
0 3 0
74
100
99

Figure 3-C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MAX CATCH RATE = 0.1919
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30.
-80.
-70.
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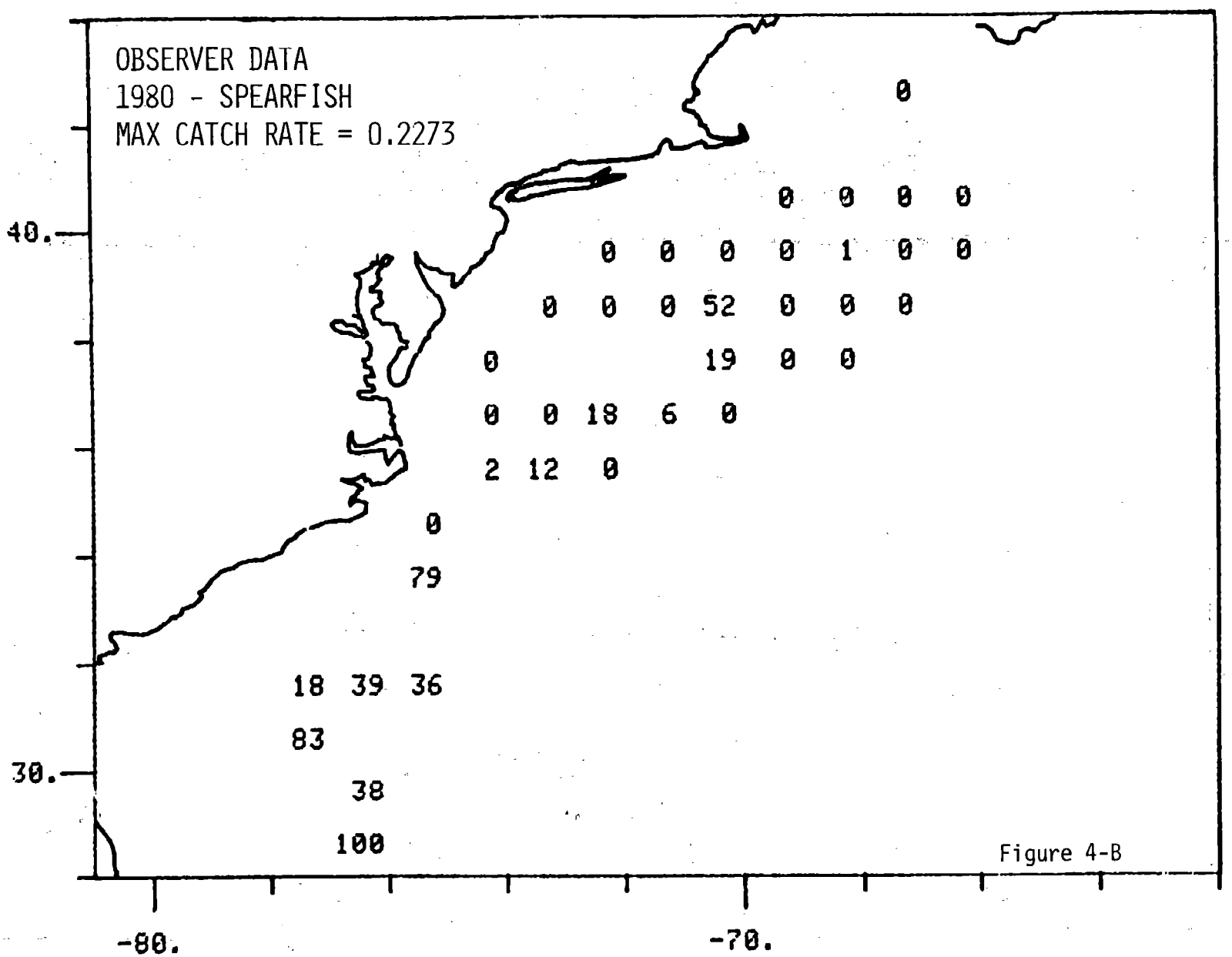
24 30 100 47 0
37 32 61 22 0
0 0 0 16
0

Figure 4-A


OBSERVER DATA
1980 - SPEARFISH
MAX CATCH RATE = 0.2273
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30.
-80.
-70.
0
0 0 0 0
0 0 0 0 1 0 0
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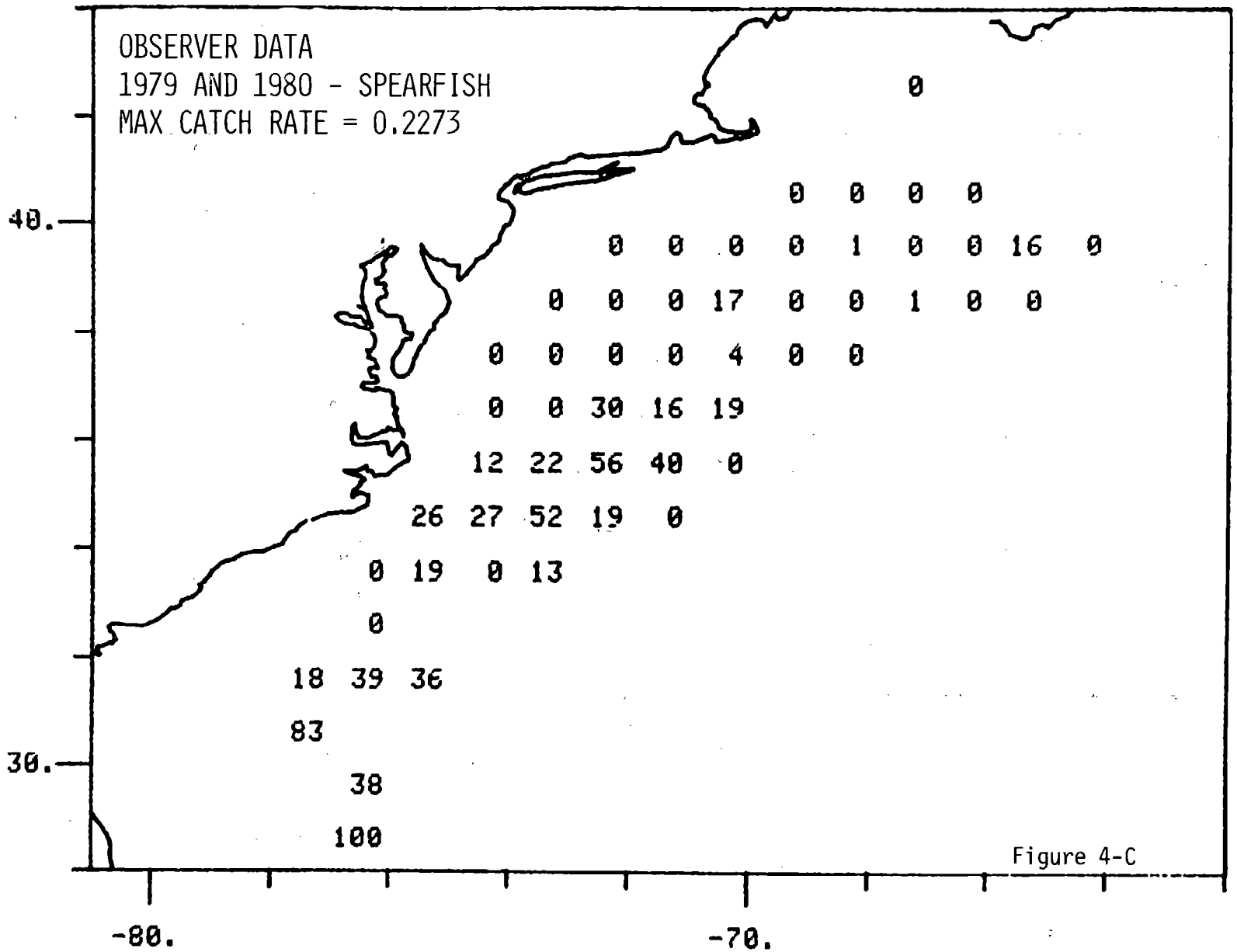
0 19 0 0
0 0 18 6 0
2 12 0
0
79
18 39 36
83
38
100

Figure 4-B


OBSERVER DATA
1979 AND 1980 - SPEARFISH
MAX CATCH RATE = 0.2273
40.
30.
-80.
-70.
0
0 0 0 0
0 0 0 0 1 0 0 16 0
0 0 0 17 0 0 1 0 0
0 0 0 0 4 0 0
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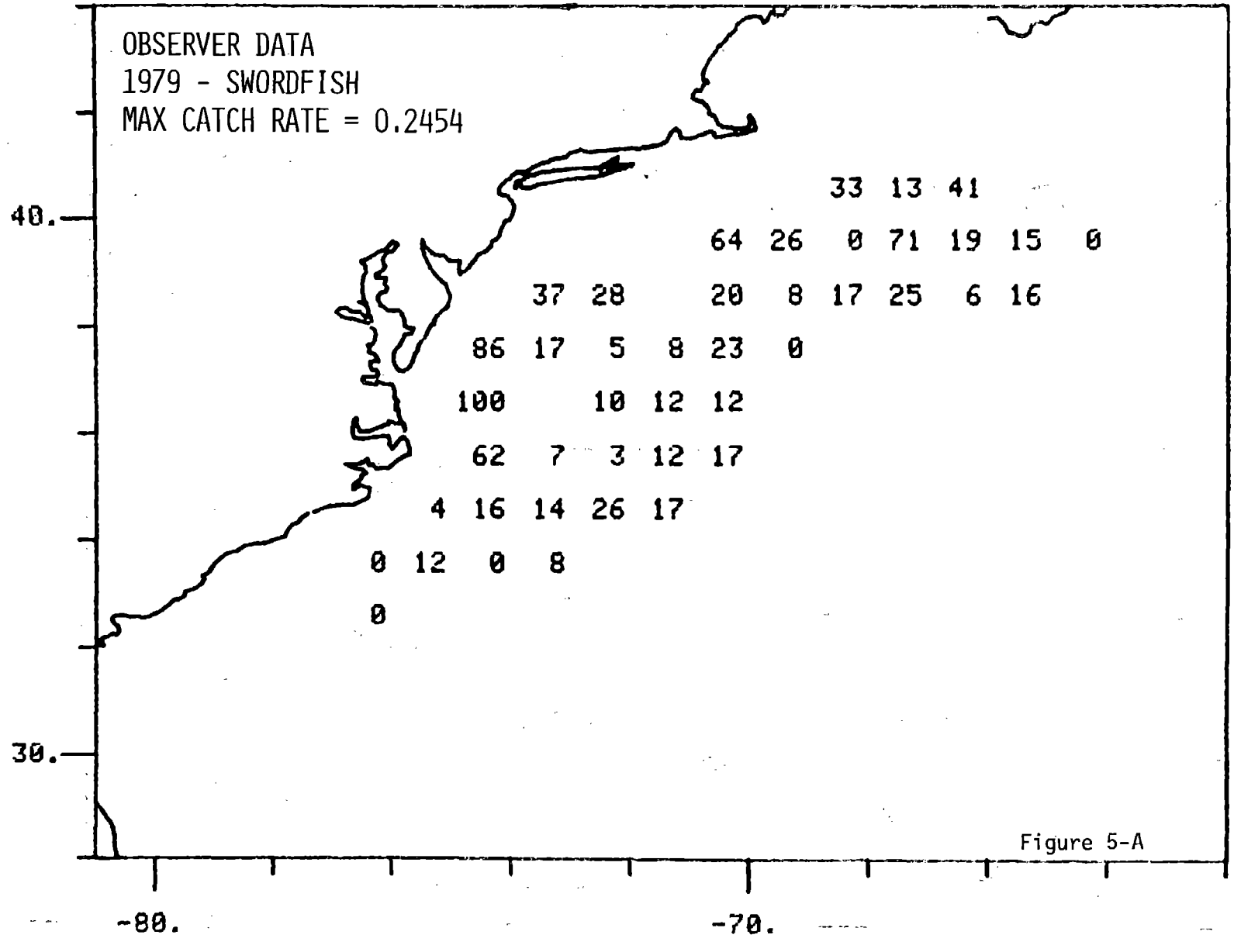
12 22 56 40 0
26 27 52 19 0
0 19 0 13
0
18 39 36
83
38
100

Figure 4-C


OBSERVER DATA
1979 - SWORDFISH
MAX CATCH RATE = 0.2454
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64 26 0 71 19 15 0
37 28 20 8 17 25 6 16
86 17 5 8 23 0
100 10 12 12
62 7 3 12 17
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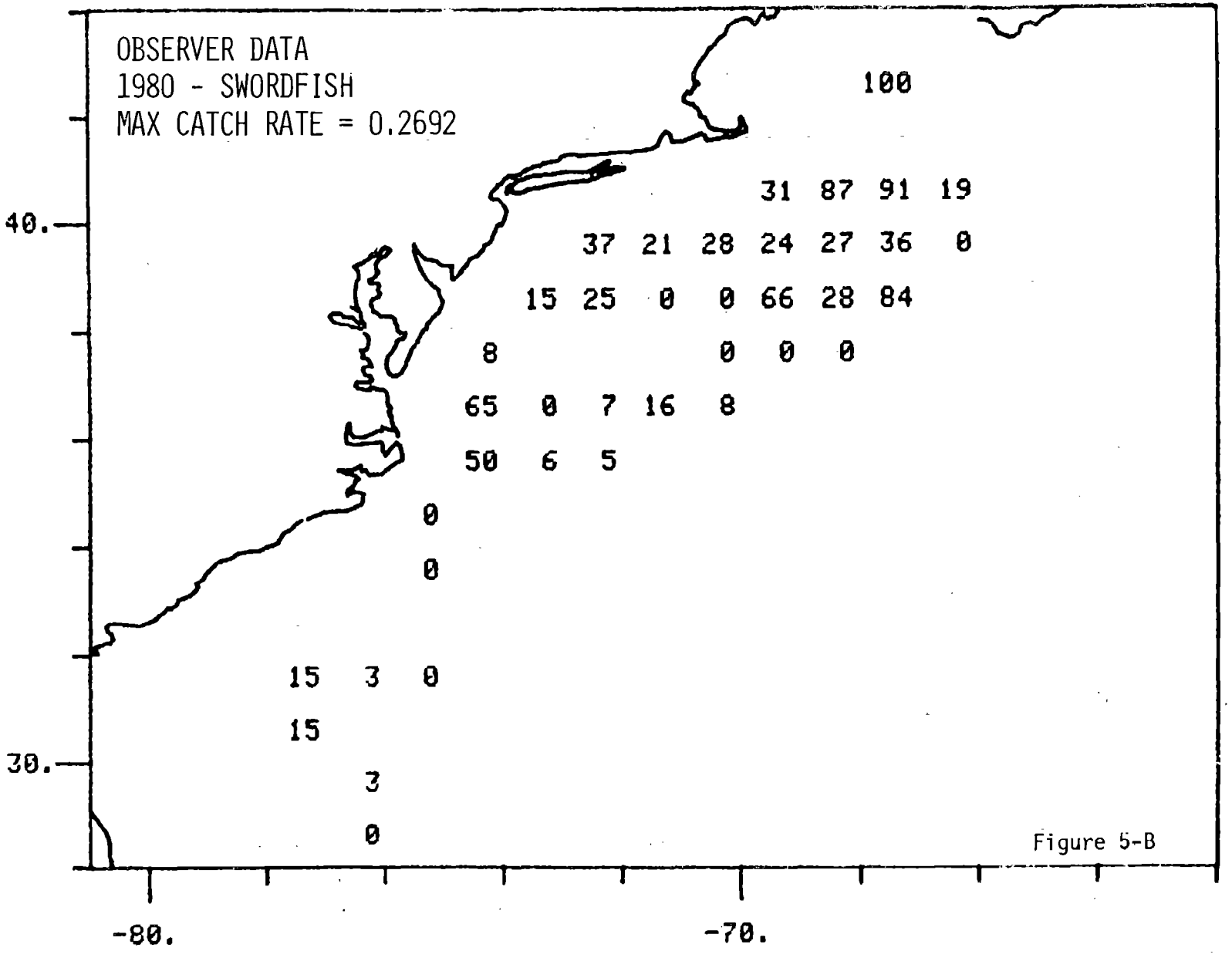
0 12 0 8
0
40.
30.
-80.
-70.

Figure 5-A


OBSERVER DATA
1980 - SWORDFISH
MAX CATCH RATE = 0.2692
100
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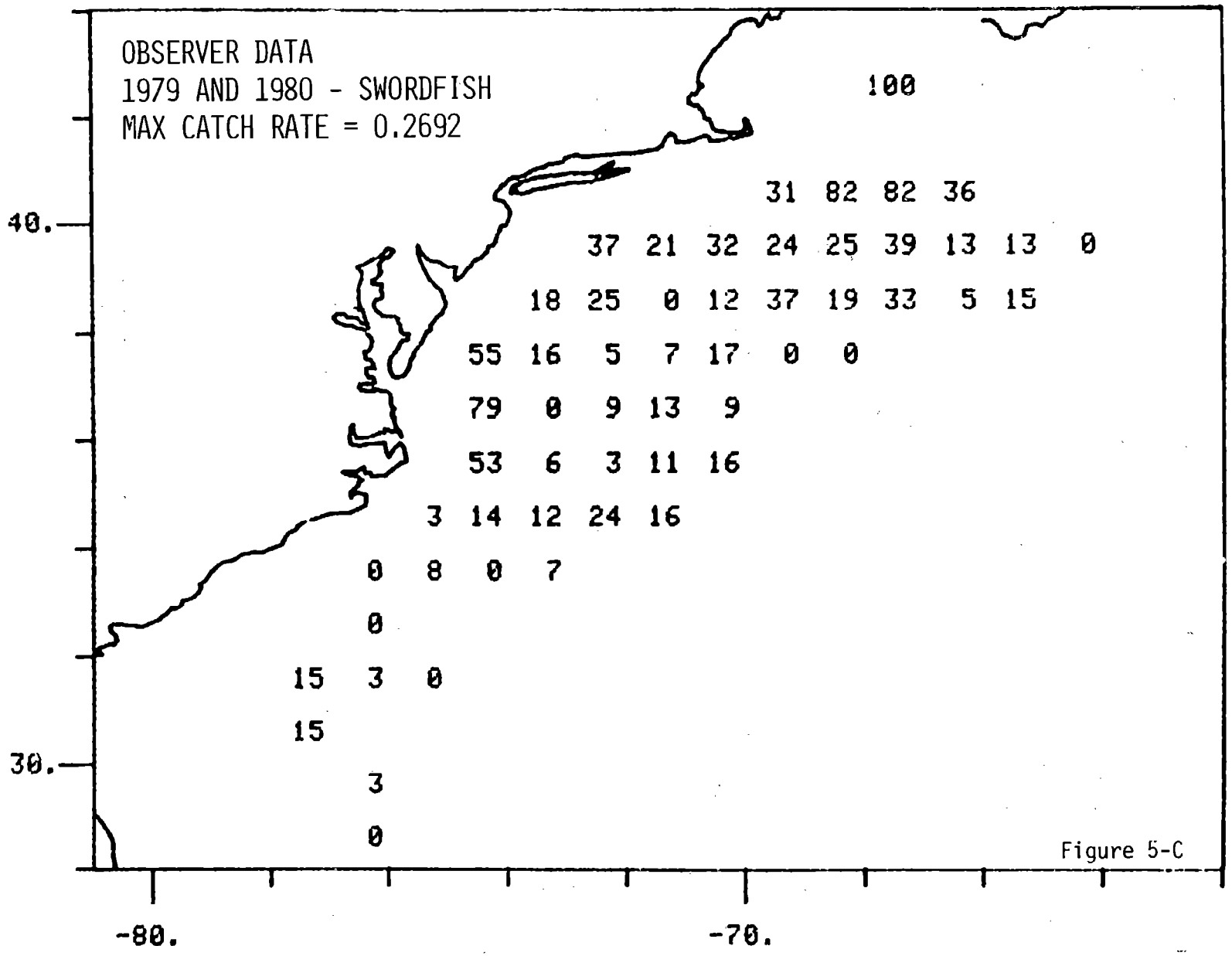
37 21 28 24 27 36 0
15 25 0 0 66 28 84
8 0 0 0
65 0 7 16 8
50 6 5
0
0
15 3 0
15
3
0
40.
30.
-80.
-70.

Figure 5-B


OBSERVER DATA
1979 AND 1980 - SWORDFISH
MAX CATCH RATE = 0.2692
100
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37 21 32 24 25 39 13 13 0
18 25 0 12 37 19 33 5 15
55 16 5 7 17 0 0
79 0 9 13 9
53 6 3 11 16
3 14 12 24 16
0 8 0 7
0
15 3 0
15
3
0
40.
30.
-80.
-70.

Figure 5-C

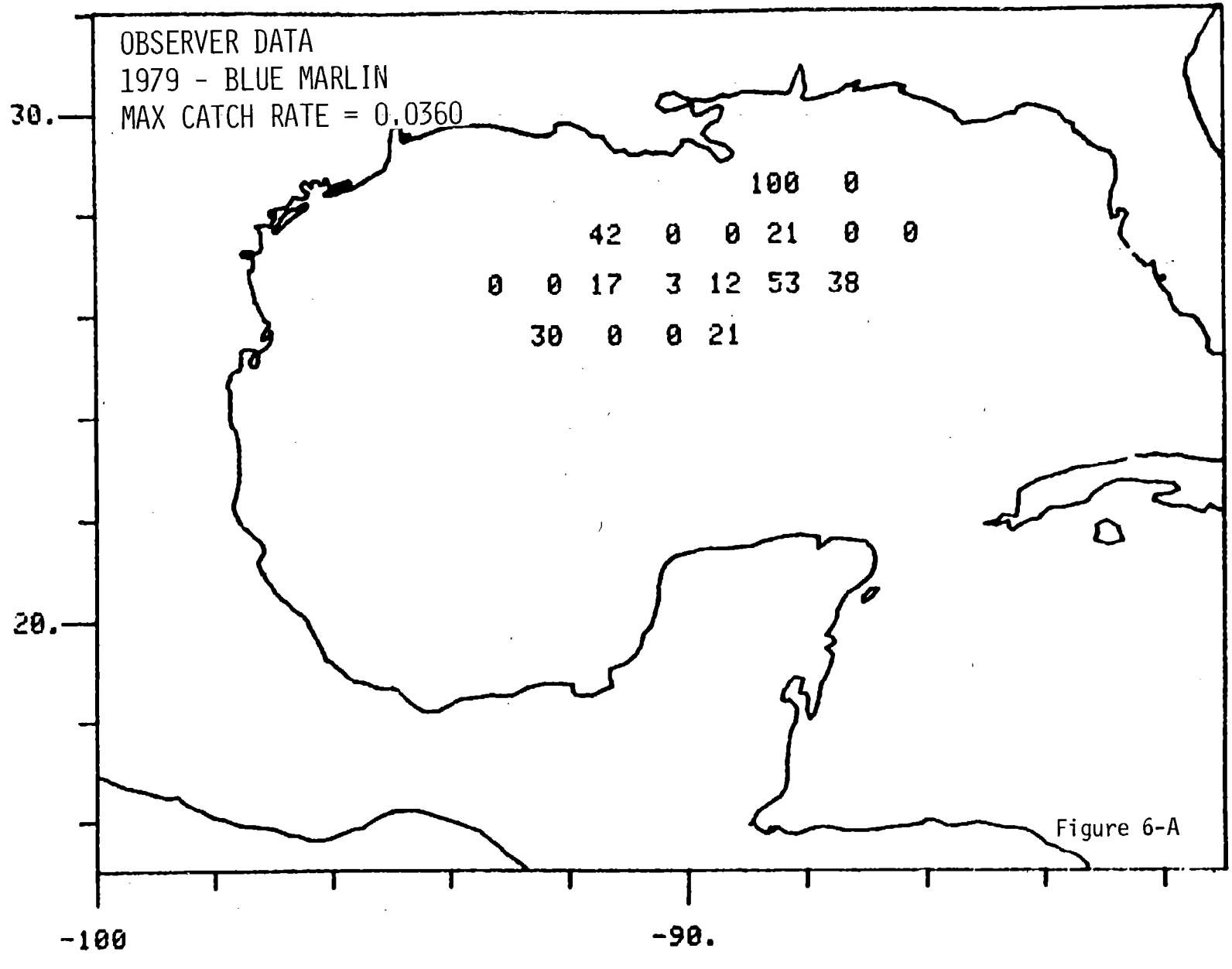

OBSERVER DATA
1979 - BLUE MARLIN
MAX CATCH RATE = 0.0360
100 0
42 0 0 21 0 0
0 0 17 3 12 53 38
30 0 0 21
30.
20.
-100
-90.

Figure 6-A

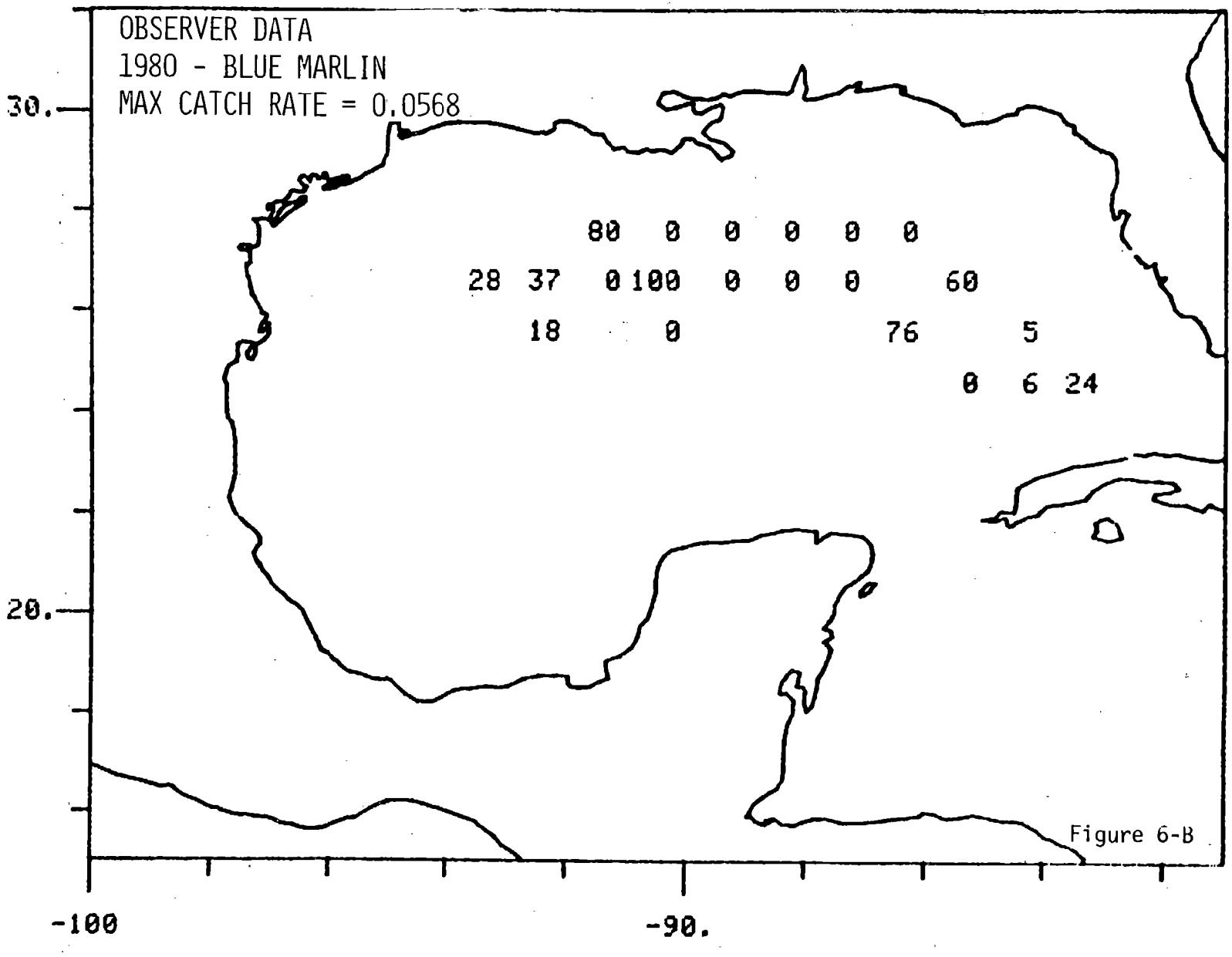

OBSERVER DATA
1980 - BLUE MARLIN
MAX CATCH RATE = 0.0568
30.
20.
-100
-90.
80 0 0 0 0 0
28 37 0 100 0 0 0 60
18 0 76 5
0 6 24

Figure 6-B

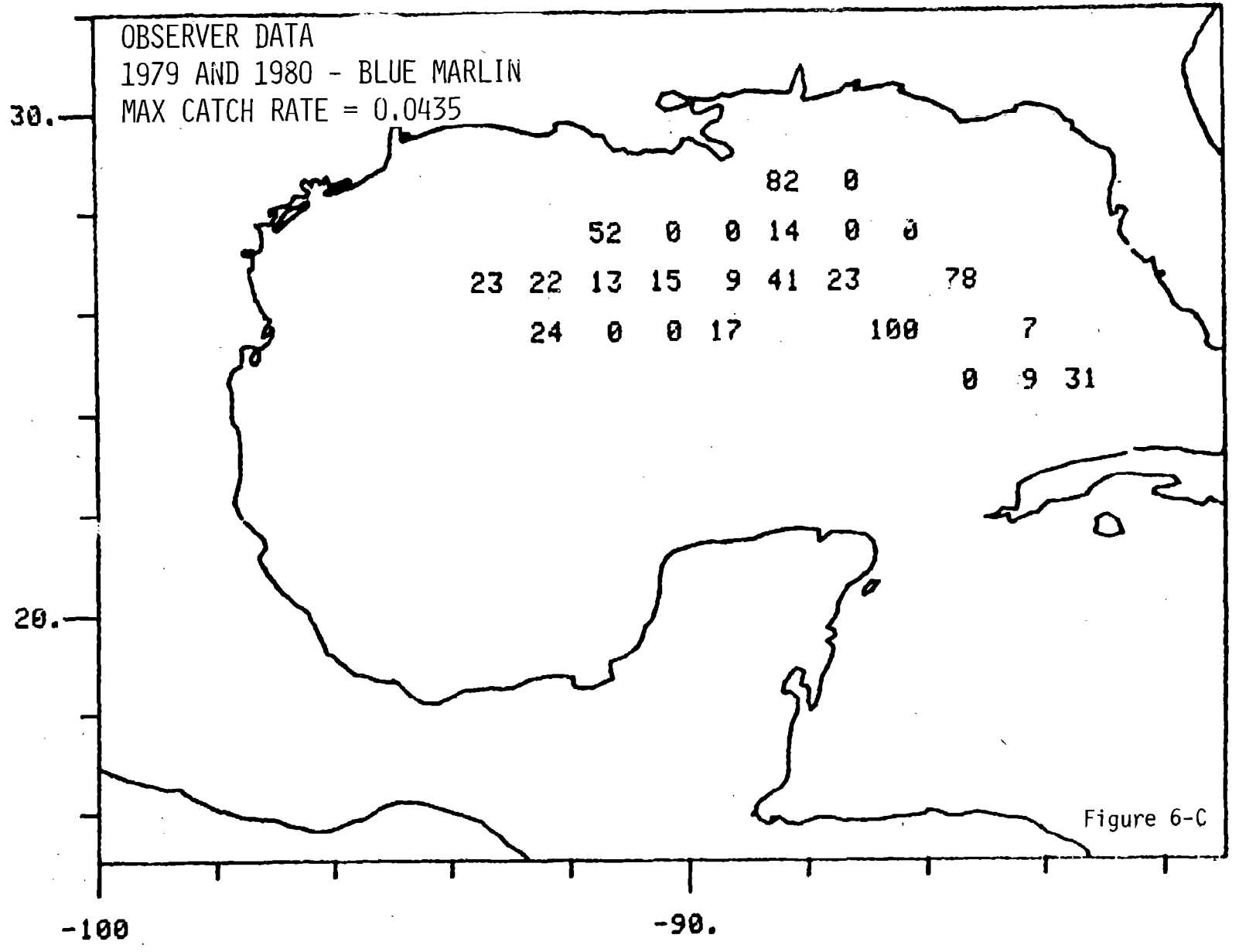

OBSERVER DATA
1979 AND 1980 - BLUE MARLIN
MAX CATCH RATE = 0.0435
30.
20.
-100
-90.
82 0
52 0 0 14 0 0
23 22 13 15 9 41 23 78
24 0 0 17 100 7
0 9 31

Figure 6-C

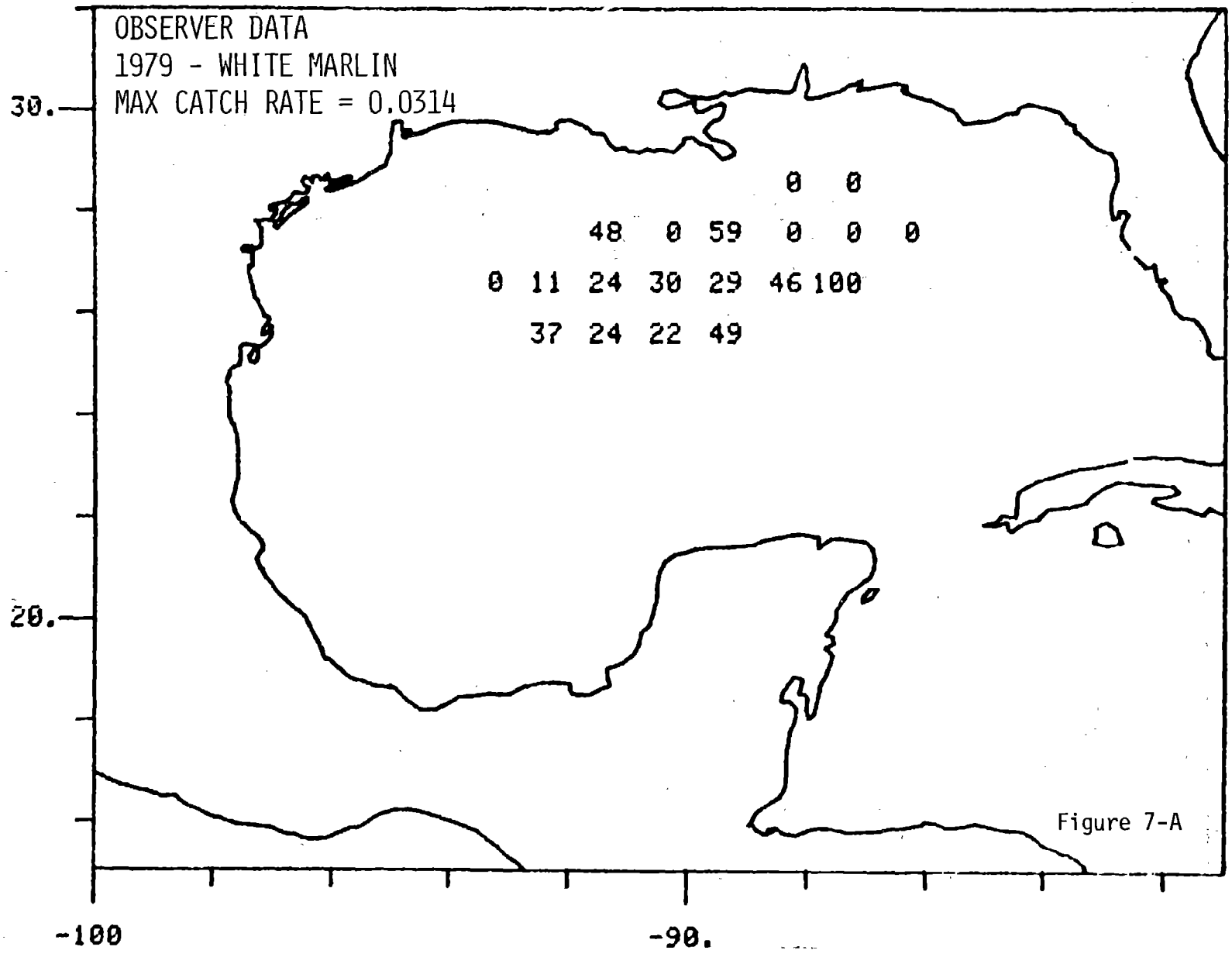

OBSERVER DATA
1979 - WHITE MARLIN
MAX CATCH RATE = 0.0314
30.
20.
-100
-90.
0 0
48 0 59 0 0 0
0 11 24 30 29 46 100
37 24 22 49

Figure 7-A

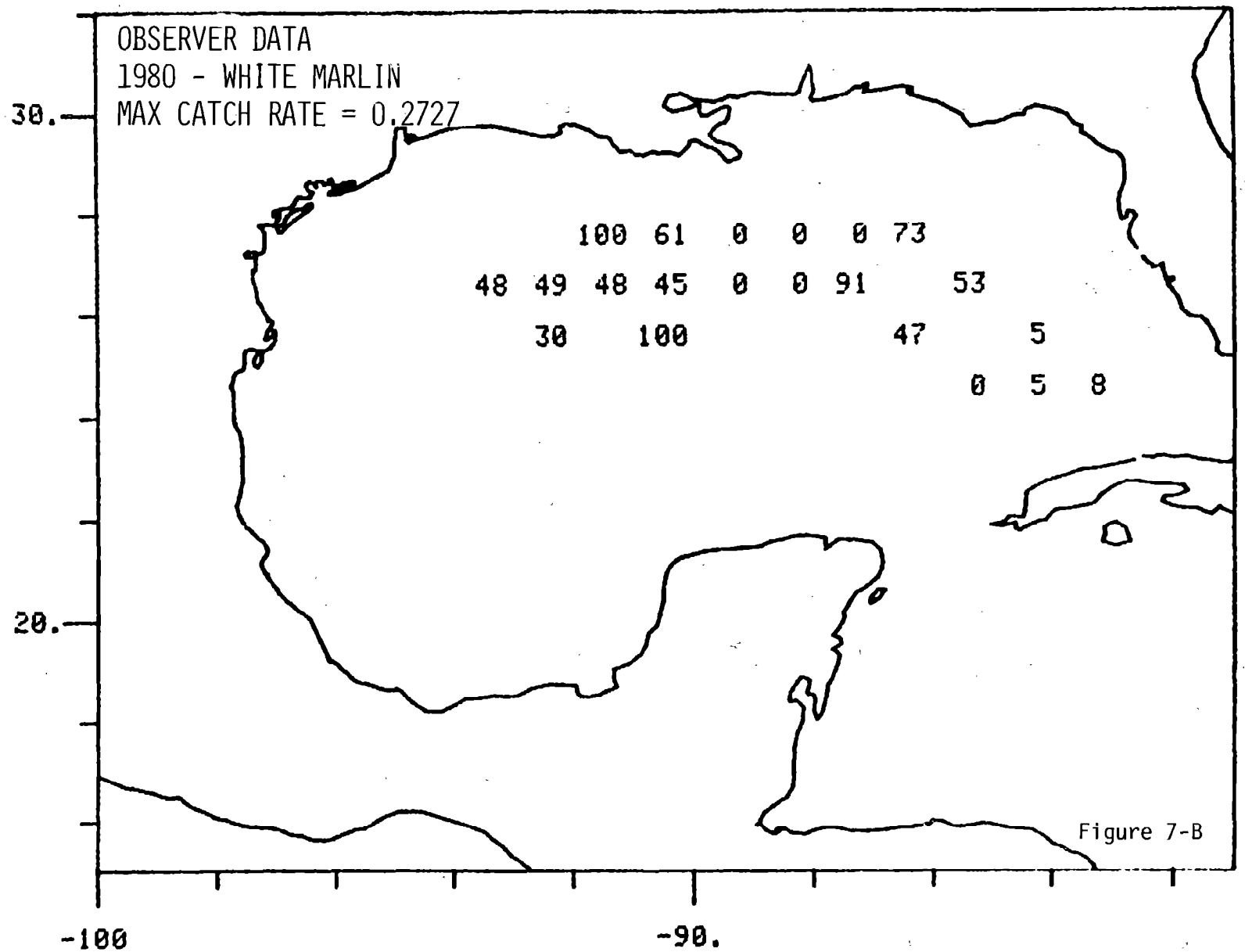

OBSERVER DATA
1980 - WHITE MARLIN
MAX CATCH RATE = 0.2727
30.
20.
-100
-90.
100 61 0 0 0 73
48 49 48 45 0 0 91 53
30 100 47 5
0 5 8

Figure 7-B

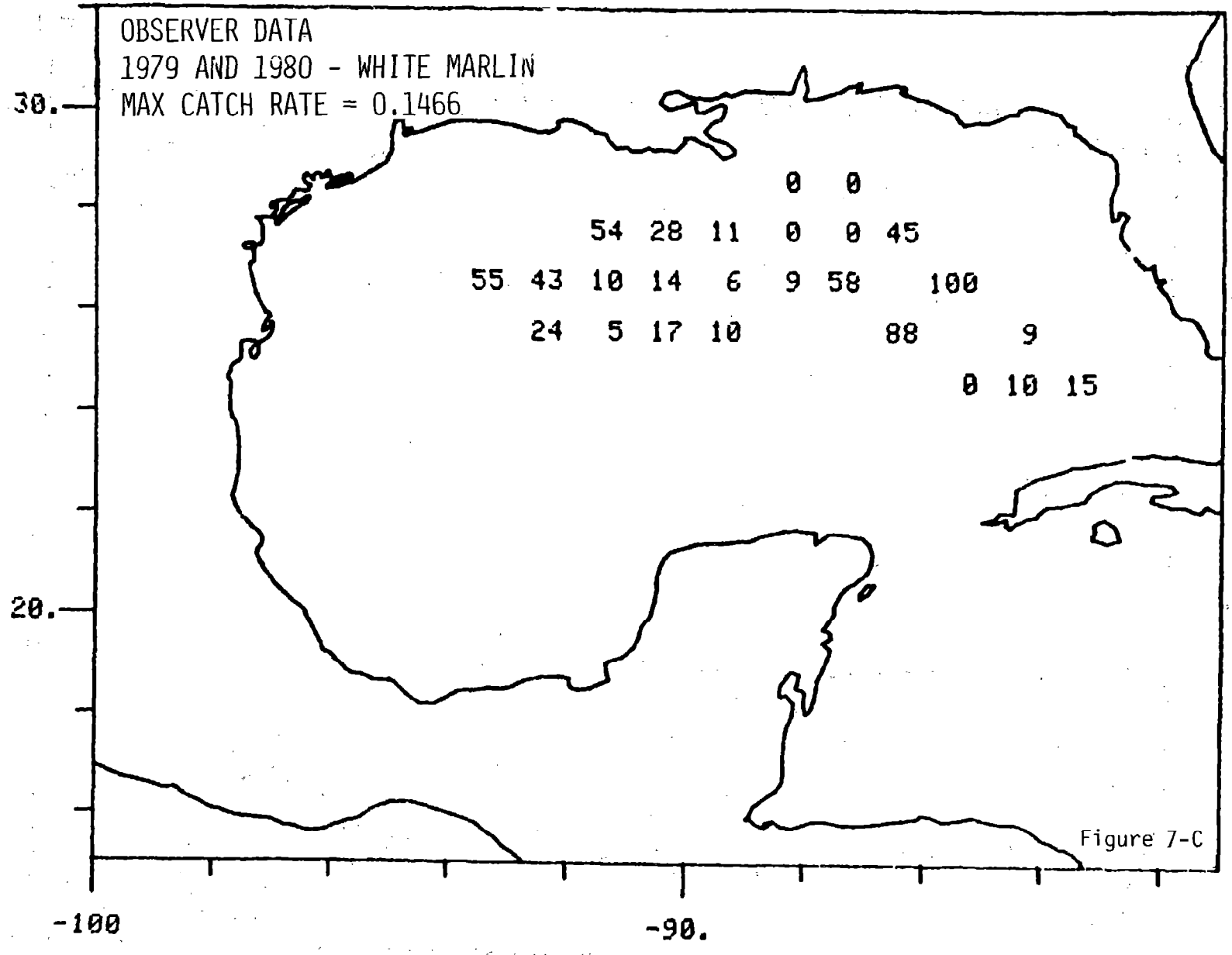

OBSERVER DATA
1979 AND 1980 - WHITE MARLIN
MAX CATCH RATE = 0.1466
30.
20.
-100
-90.
0 0
54 28 11 0 0 45
55 43 10 14 6 9 58 100
24 5 17 10 88 9
0 10 15

Figure 7-C

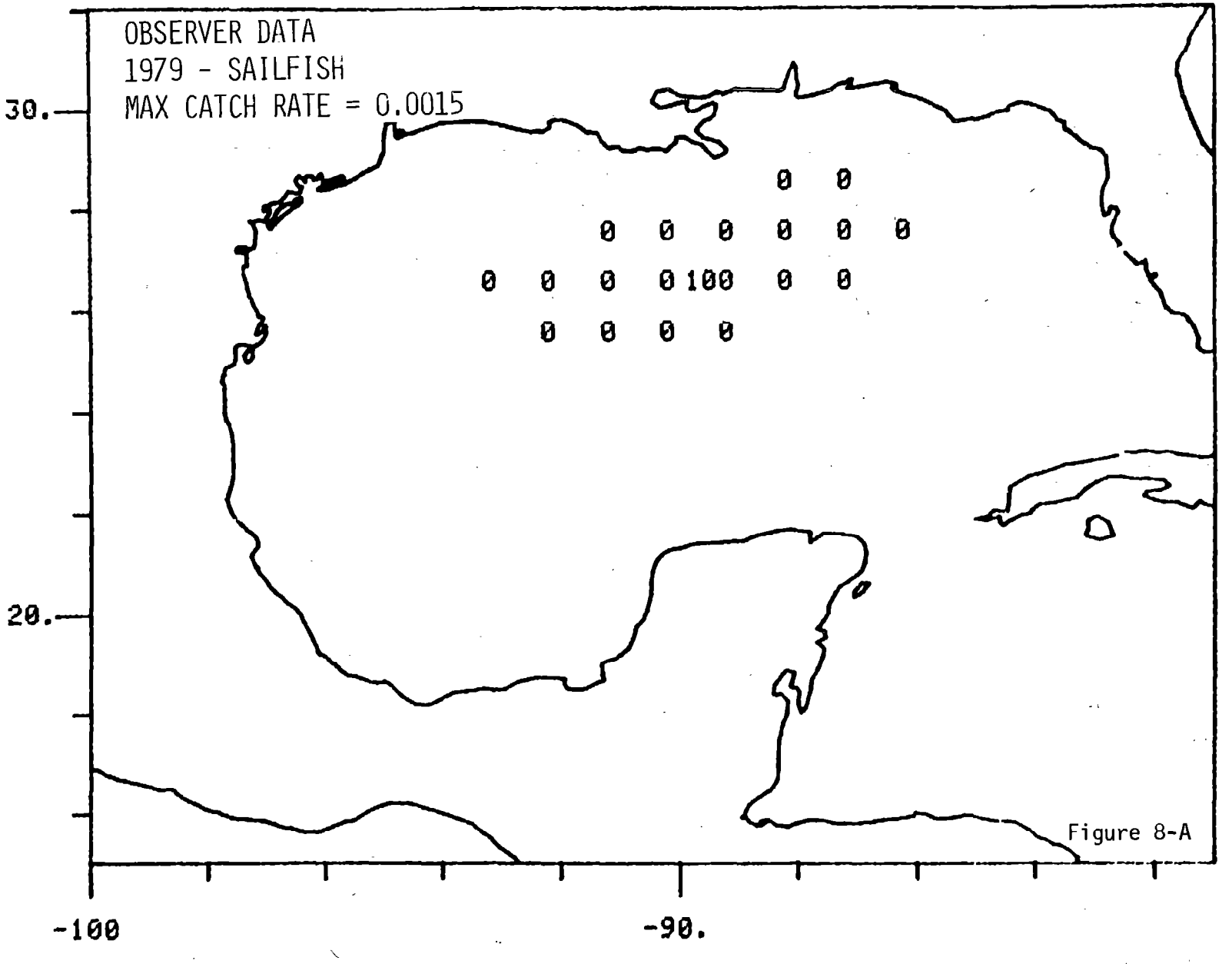

OBSERVER DATA
1979 - SAILFISH
MAX CATCH RATE = 0.0015
30.
20.
-100
-90.
0 0
0 0 0 0 0 0
0 0 0 0 100 0 0
0 0 0 0

Figure 8-A

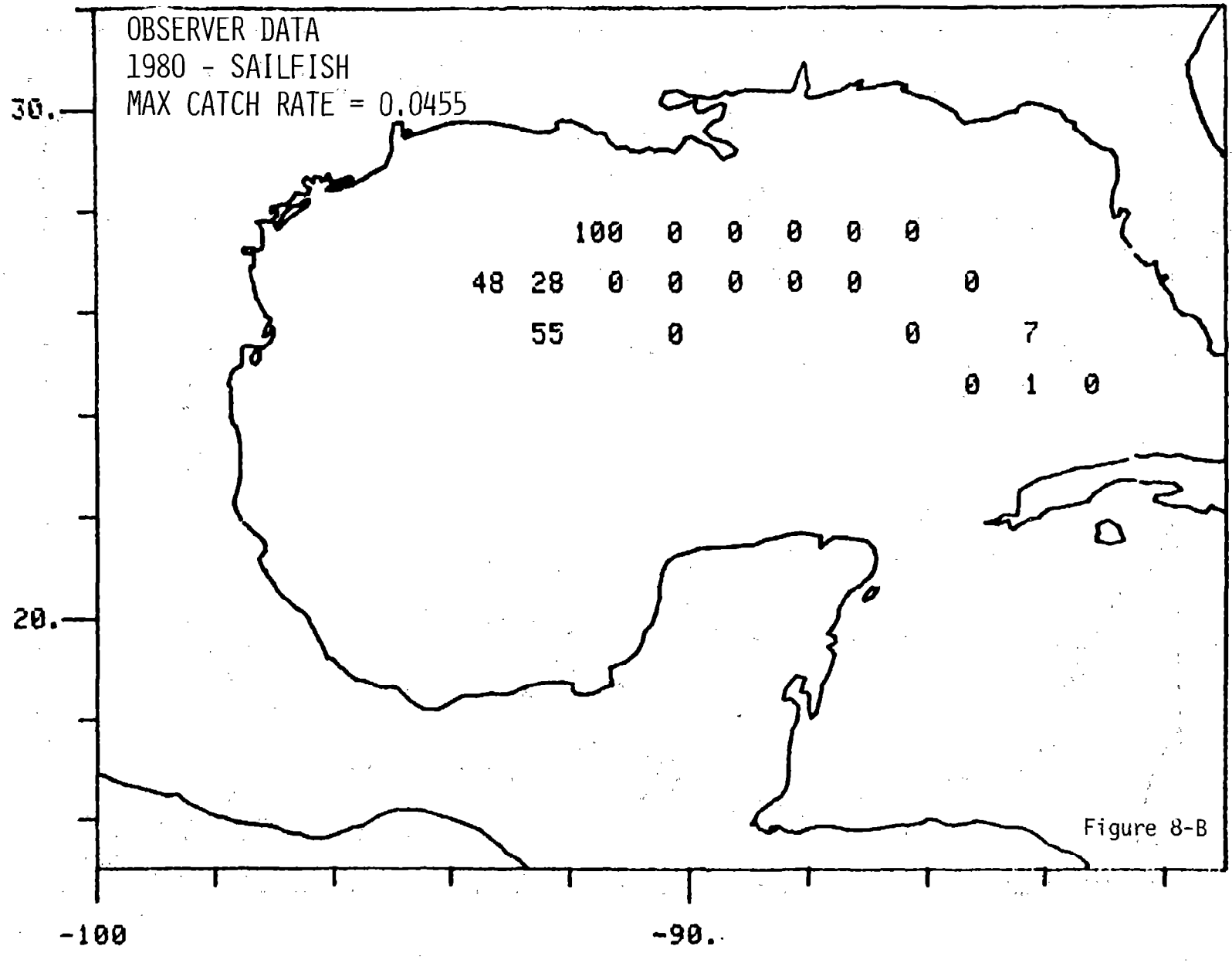

OBSERVER DATA
1980 - SAILFISH
MAX CATCH RATE = 0.0455
30.
20.
-100
-90.
100 0 0 0 0 0
48 28 0 0 0 0 0 0
55 0 0 7
0 1 0

Figure 8-B

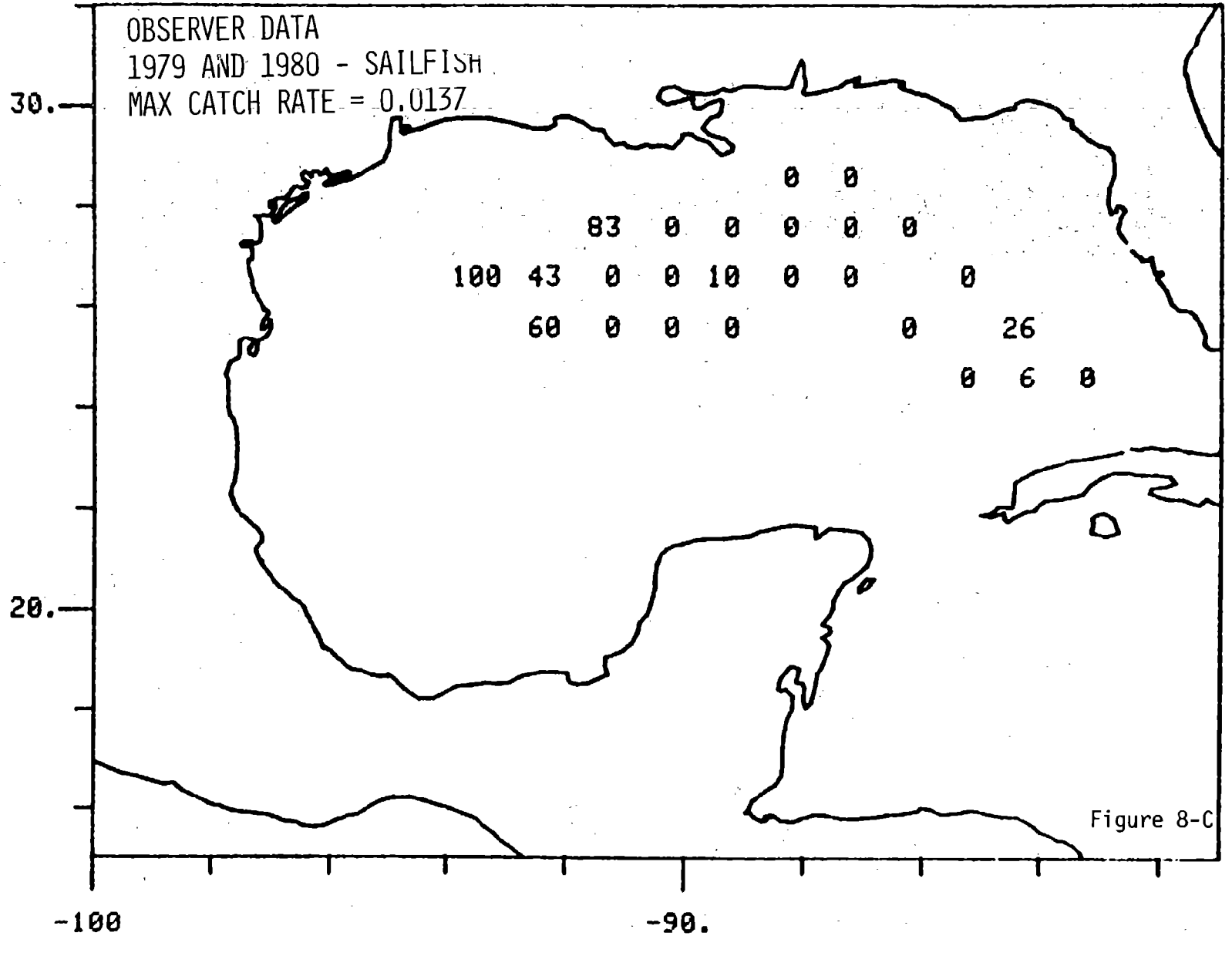

OBSERVER DATA
1979 AND 1980 - SAILFISH
MAX CATCH RATE = 0.0137
30.
20.
-100
-90.
0 0
83 0 0 0 0 0
100 43 0 0 10 0 0 0
60 0 0 0 0 26
0 6 0

Figure 8-C

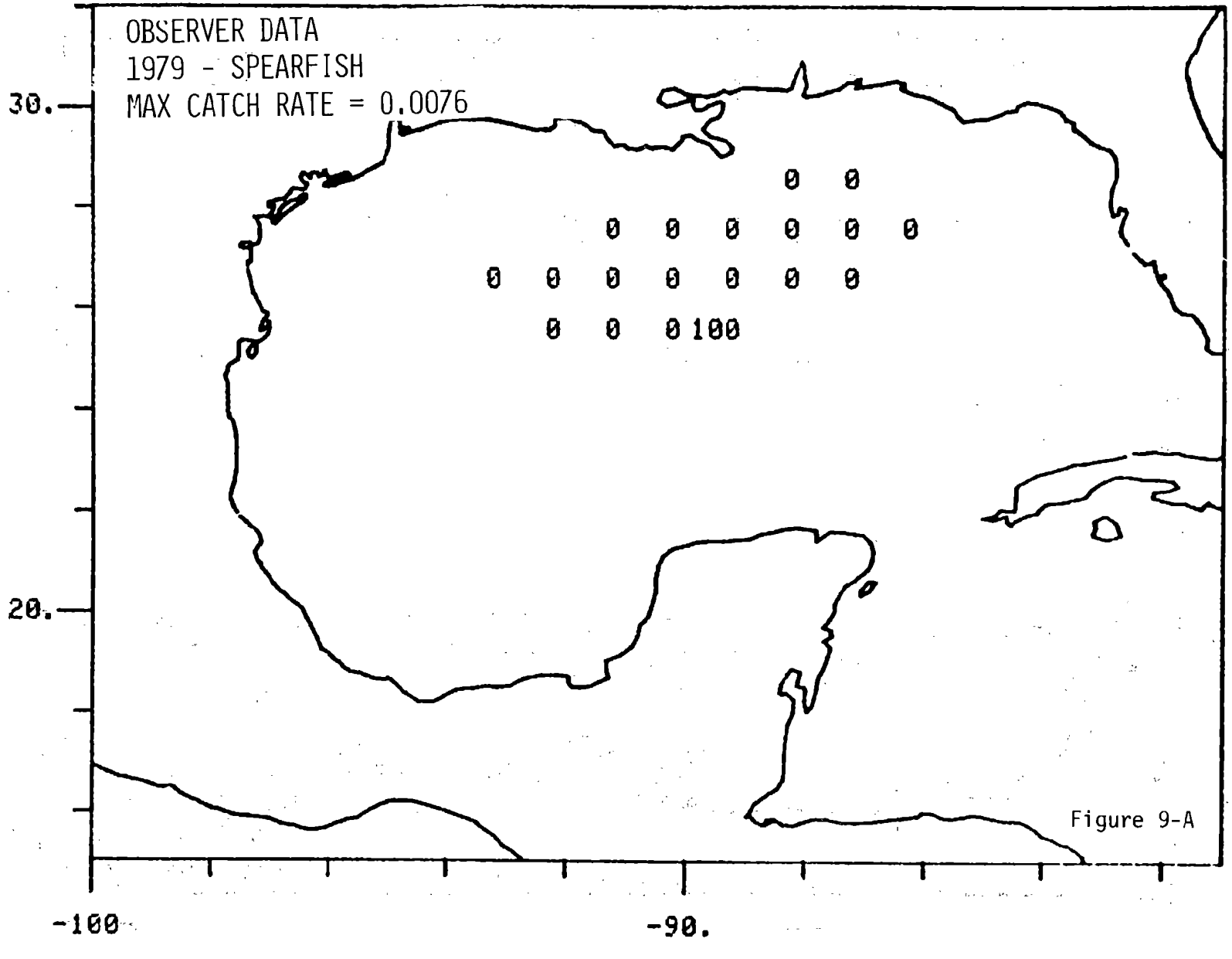

OBSERVER DATA
1979 - SPEARFISH
MAX CATCH RATE = 0.0076
30.
20.
-100
-90.
0 0
0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 100

Figure 9-A

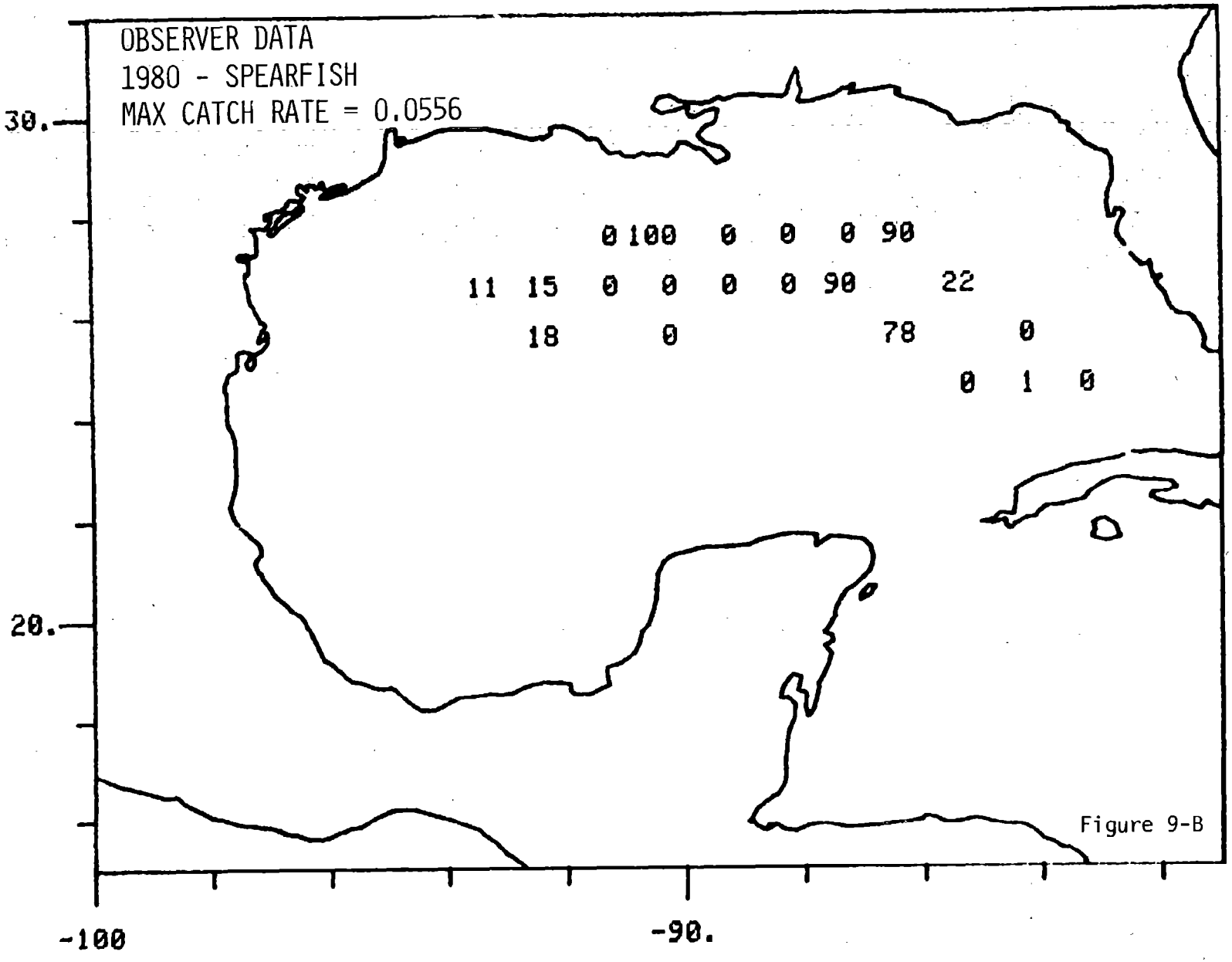

OBSERVER DATA
1980 - SPEARFISH
MAX CATCH RATE = 0.0556
30.
20.
-100
-90.
0 100 0 0 0 90
11 15 0 0 0 0 90 22
18 0 78 0
0 1 0

Figure 9-B

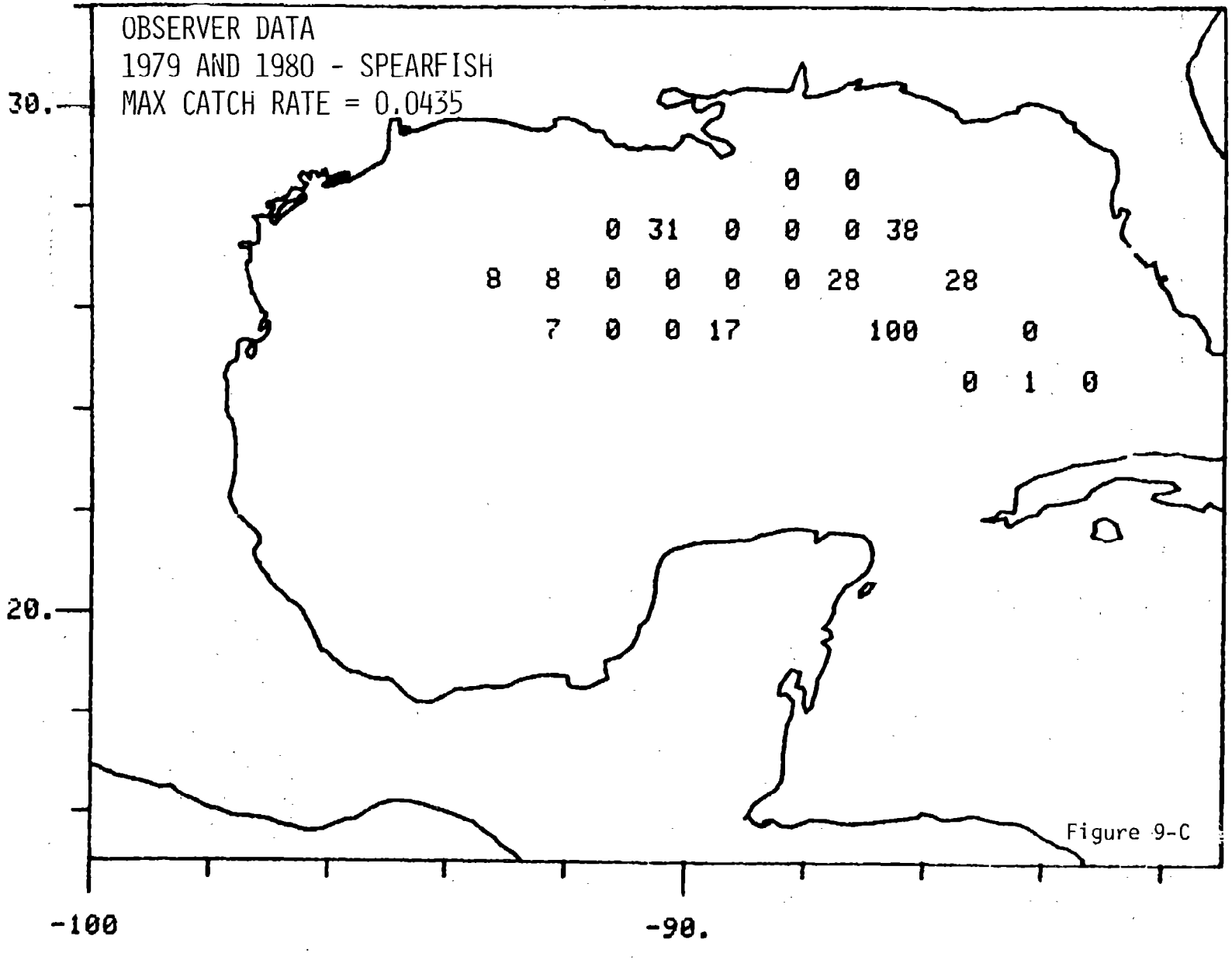

OBSERVER DATA
1979 AND 1980 - SPEARFISH
MAX CATCH RATE = 0.0435
30.
20.
-100
-90.
0 0
0 31 0 0 0 38
8 8 0 0 0 0 28 28
7 0 0 17 100 0
0 1 0

Figure 9-C

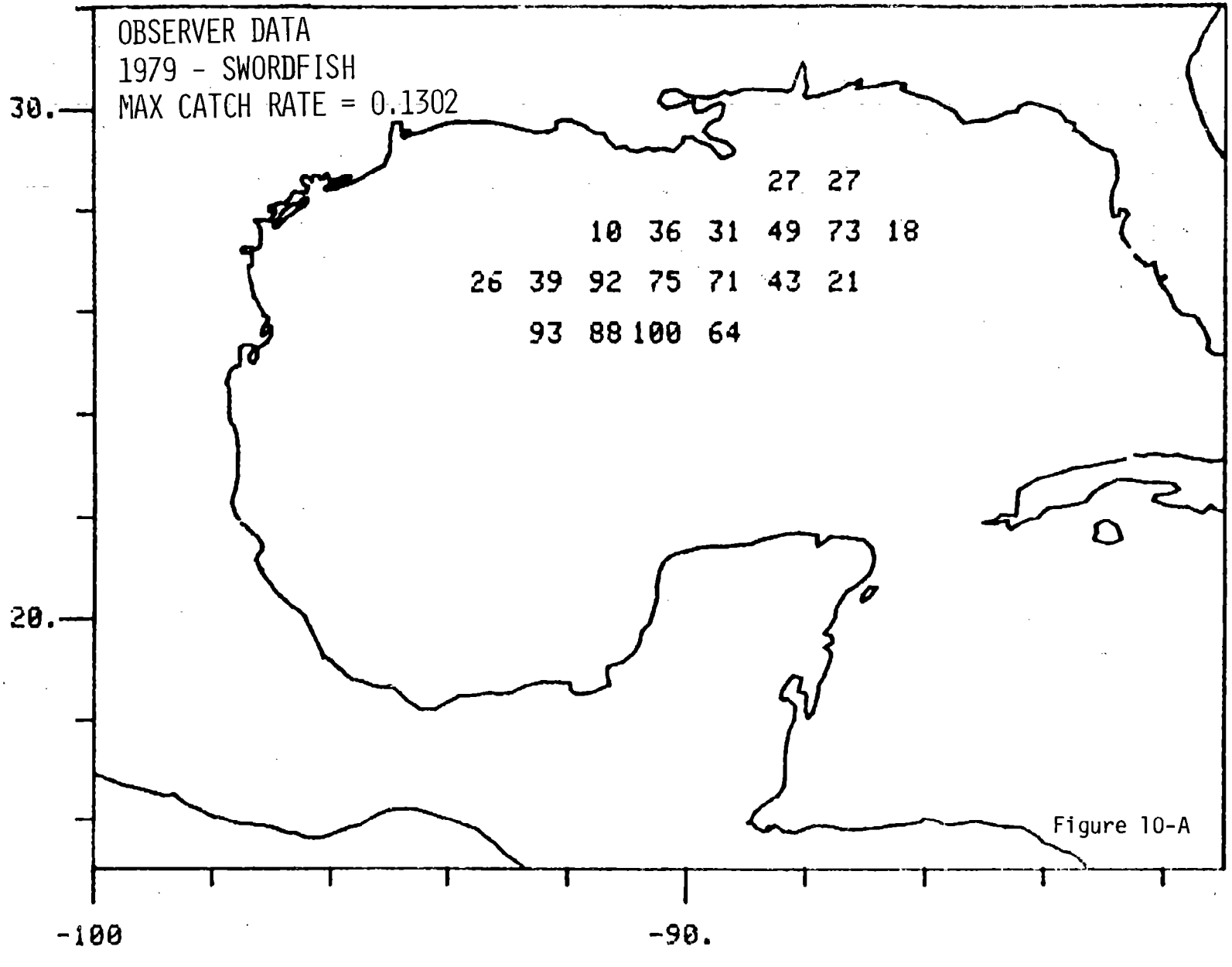

OBSERVER DATA
1979 - SWORDFISH
MAX CATCH RATE = 0.1302
30.
20.
-100
-90.
27 27
10 36 31 49 73 18
26 39 92 75 71 43 21
93 88 100 64

Figure 10-A

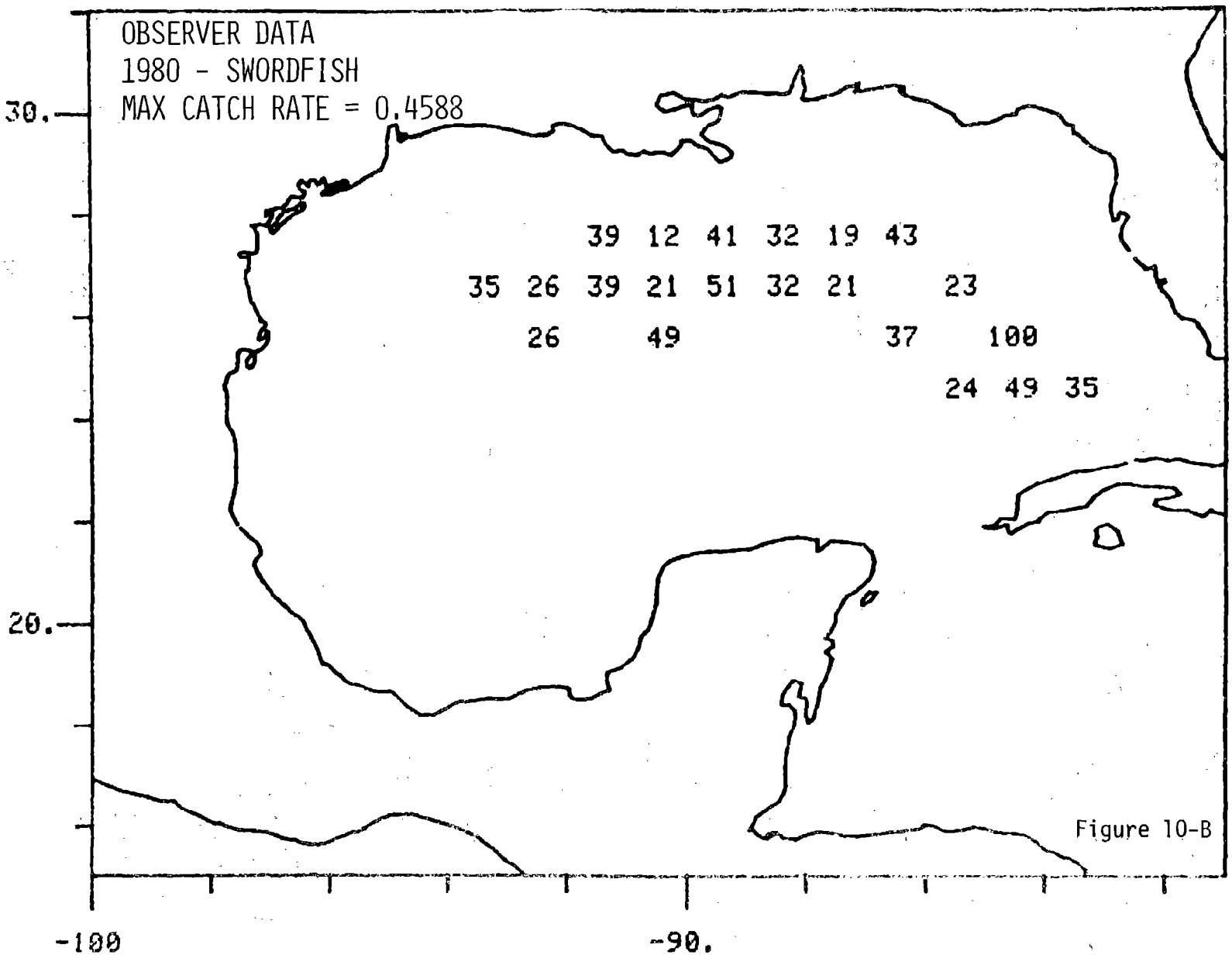

OBSERVER DATA
1980 - SWORDFISH
MAX CATCH RATE = 0.4588
30.
20.
-100
-90.
39 12 41 32 19 43
35 26 39 21 51 32 21 23
26 49 37 100
24 49 35

Figure 10-B

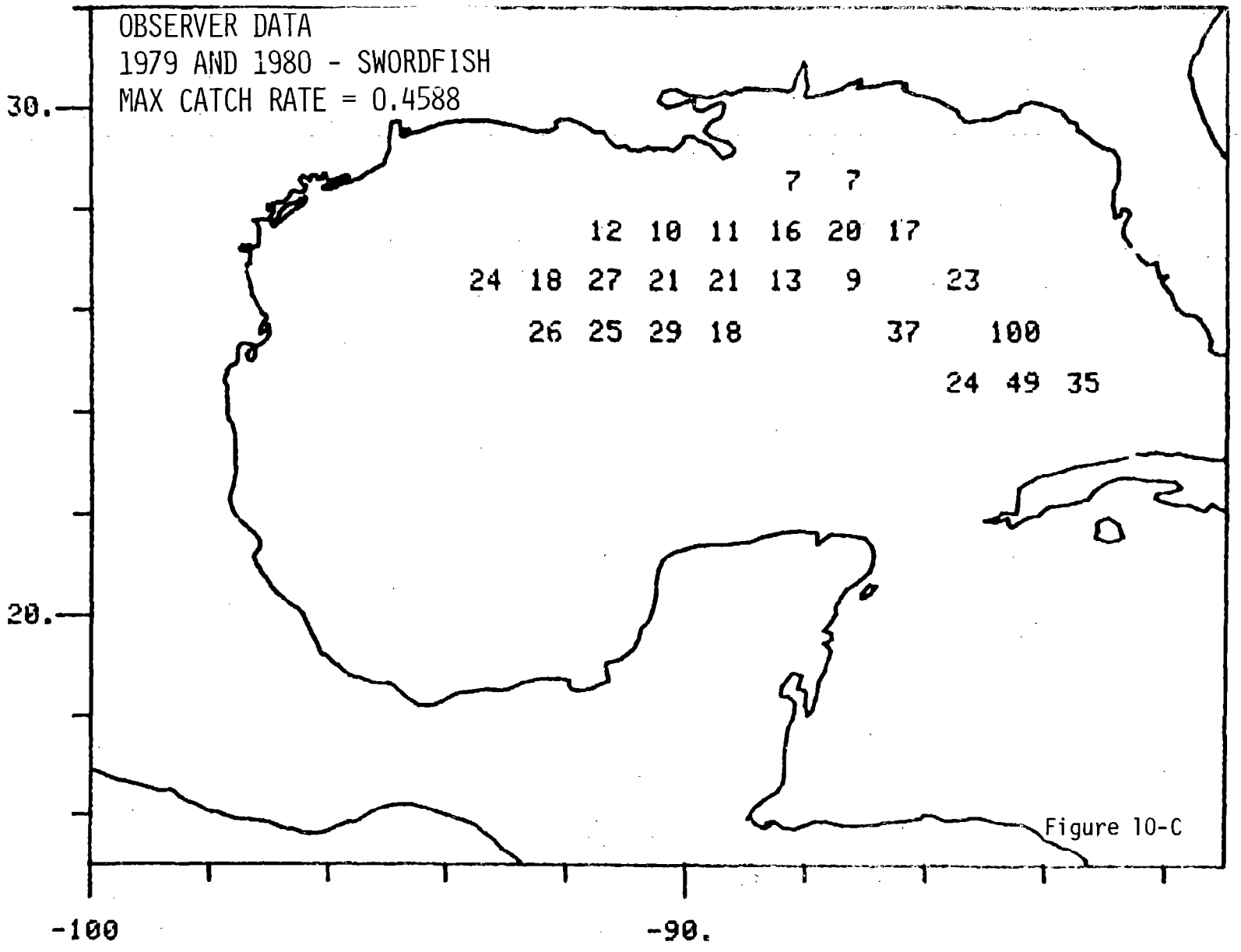

OBSERVER DATA
1979 AND 1980 - SWORDFISH
MAX CATCH RATE = 0.4588
30.
20.
-100
-90.
7 7
12 10 11 16 20 17
24 18 27 21 21 13 9 23
26 25 29 18 37 100
24 49 35

Figure 10-C

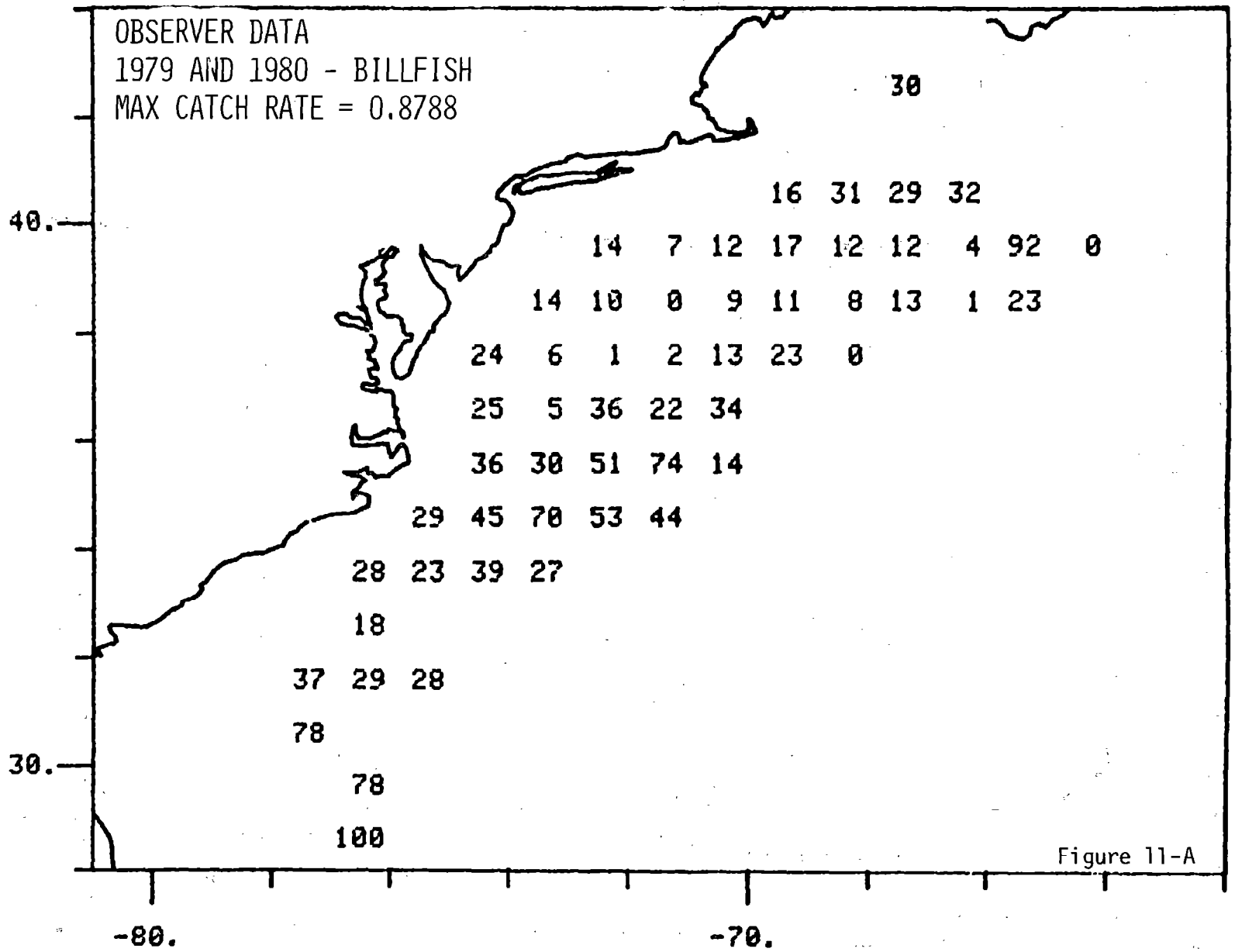

OBSERVER DATA
1979 AND 1980 - BILLFISH
MAX CATCH RATE = 0.8788
30
16 31 29 32
14 7 12 17 12 12 4 92 0
14 10 0 9 11 8 13 1 23
24 6 1 2 13 23 0
25 5 36 22 34
36 30 51 74 14
29 45 70 53 44
28 23 39 27
18
37 29 28
78
78
100
40.
30.
-80.
-70.

Figure 11-A

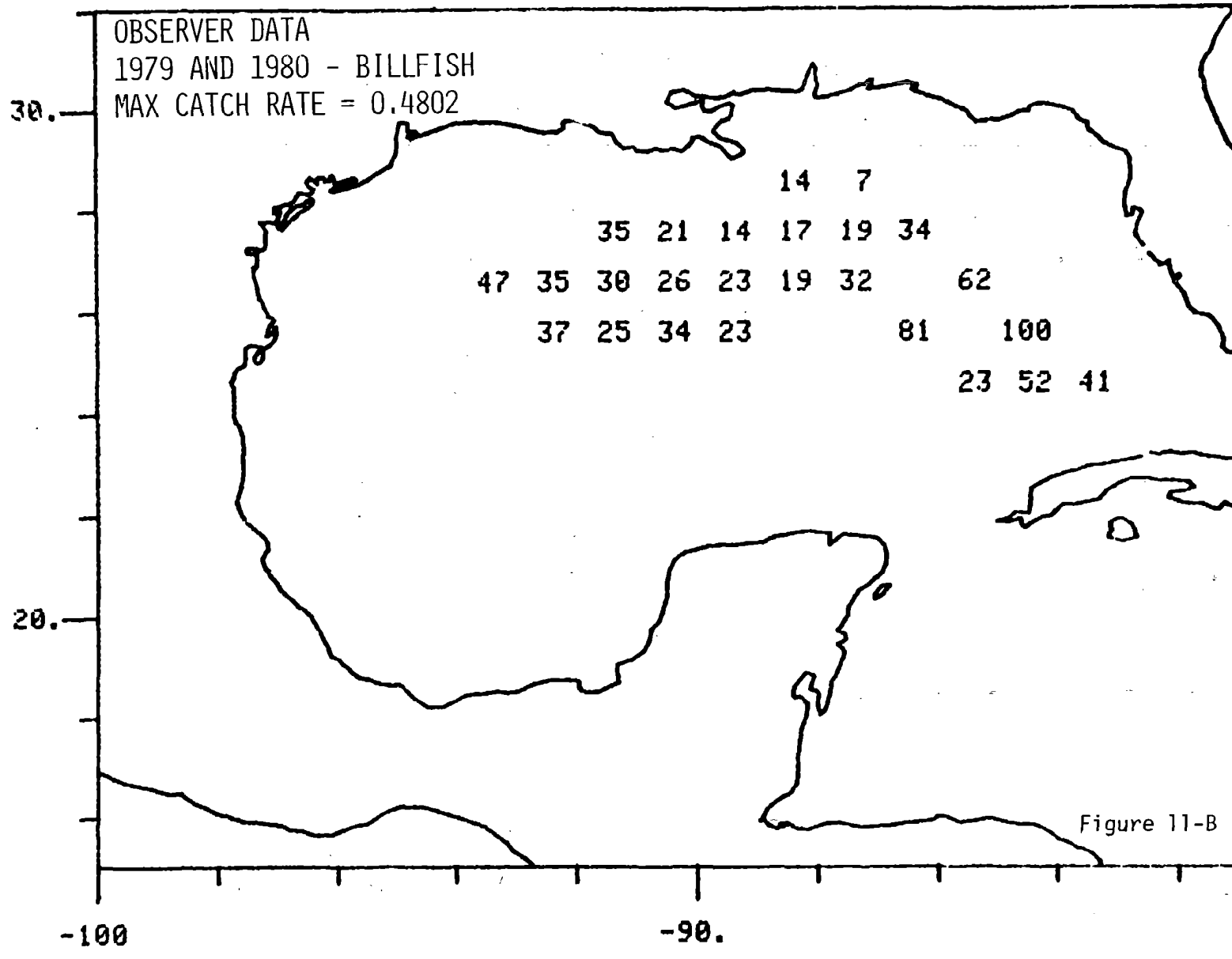

OBSERVER DATA
1979 AND 1980 - BILLFISH
MAX CATCH RATE = 0.4802
30.
20.
-100
-90.
14 7
35 21 14 17 19 34
47 35 30 26 23 19 32 62
37 25 34 23 81 100
23 52 41

Figure 11-B

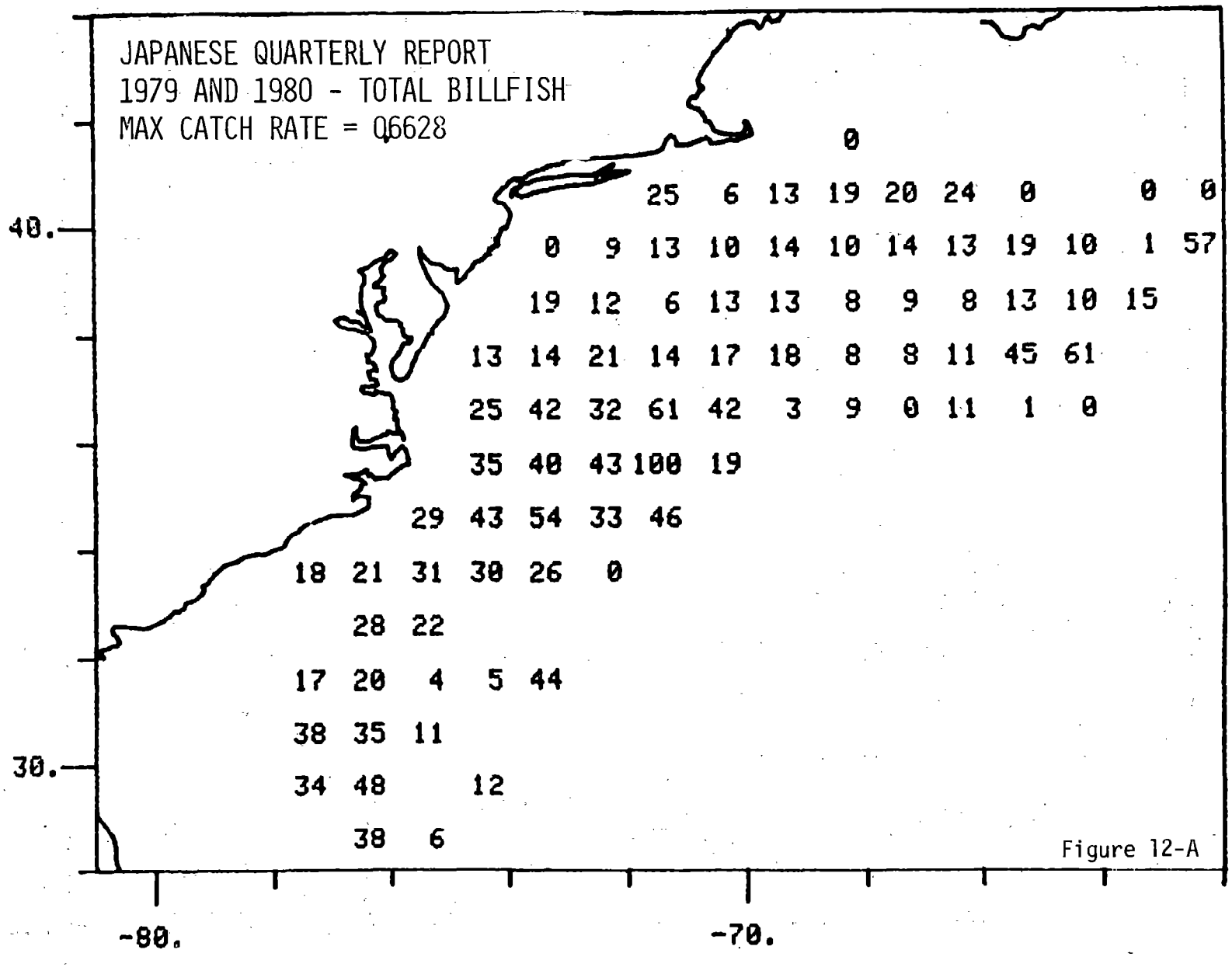

JAPANESE QUARTERLY REPORT
1979 AND 1980 - TOTAL BILLFISH
MAX CATCH RATE = 06628
0
25 6 13 19 20 24 0 0 0
0 9 13 10 14 10 14 13 19 10 1 57
19 12 6 13 13 8 9 8 13 10 15
13 14 21 14 17 18 8 8 11 45 61
25 42 32 61 42 3 9 0 11 1 0
35 40 43 100 19
29 43 54 33 46
18 21 31 30 26 0
28 22
17 20 4 5 44
38 35 11
34 48 12
38 6
40.
30.
-80.
-70.

Figure 12-A

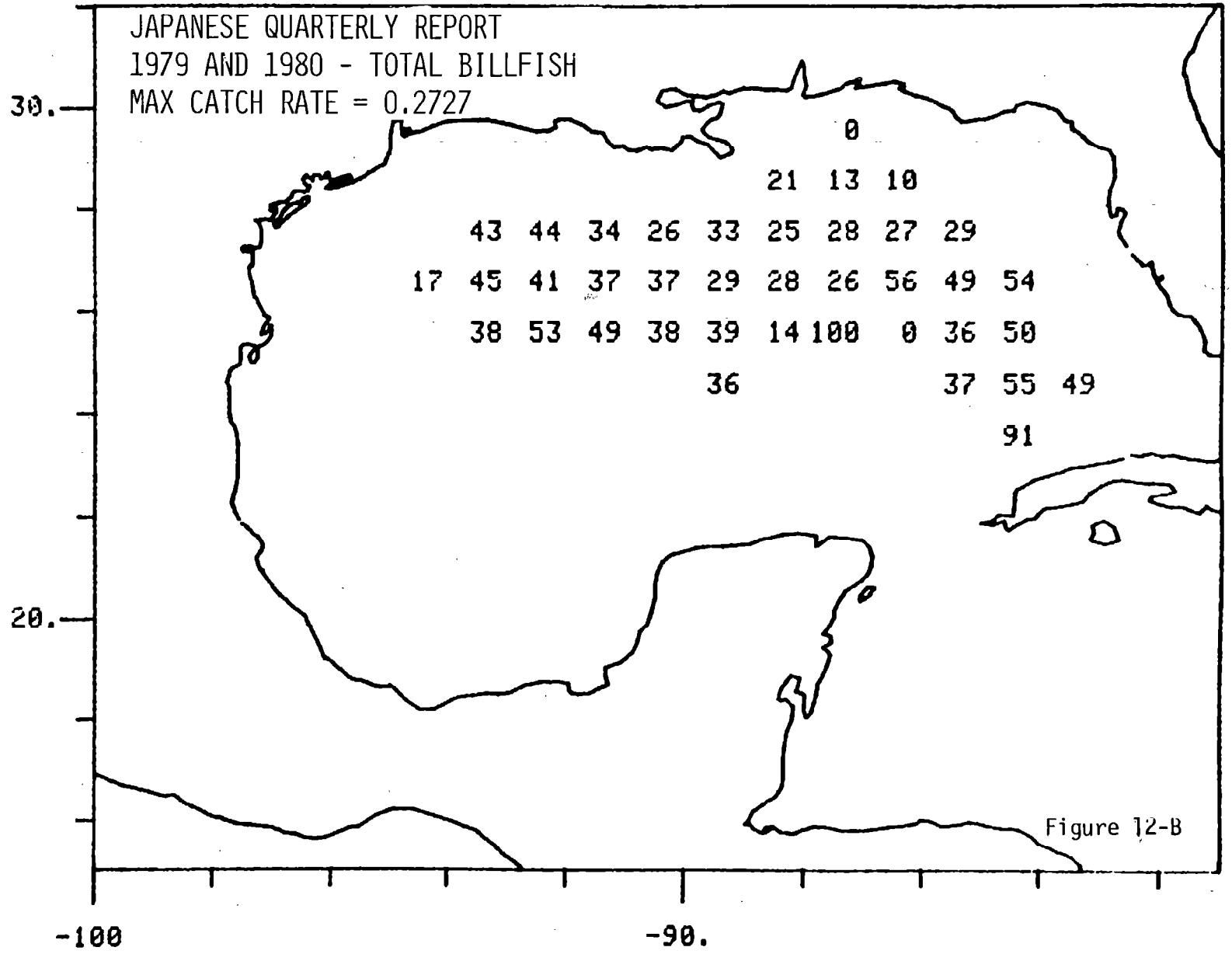

JAPANESE QUARTERLY REPORT
1979 AND 1980 - TOTAL BILLFISH
MAX CATCH RATE = 0.2727
30.
20.
-100
-90.
0
21 13 10
43 44 34 26 33 25 28 27 29
17 45 41 37 37 29 28 26 56 49 54
38 53 49 38 39 14 100 0 36 50
36 37 55 49
91

Figure 12-B

Appendix F

LIST OF FIGURES

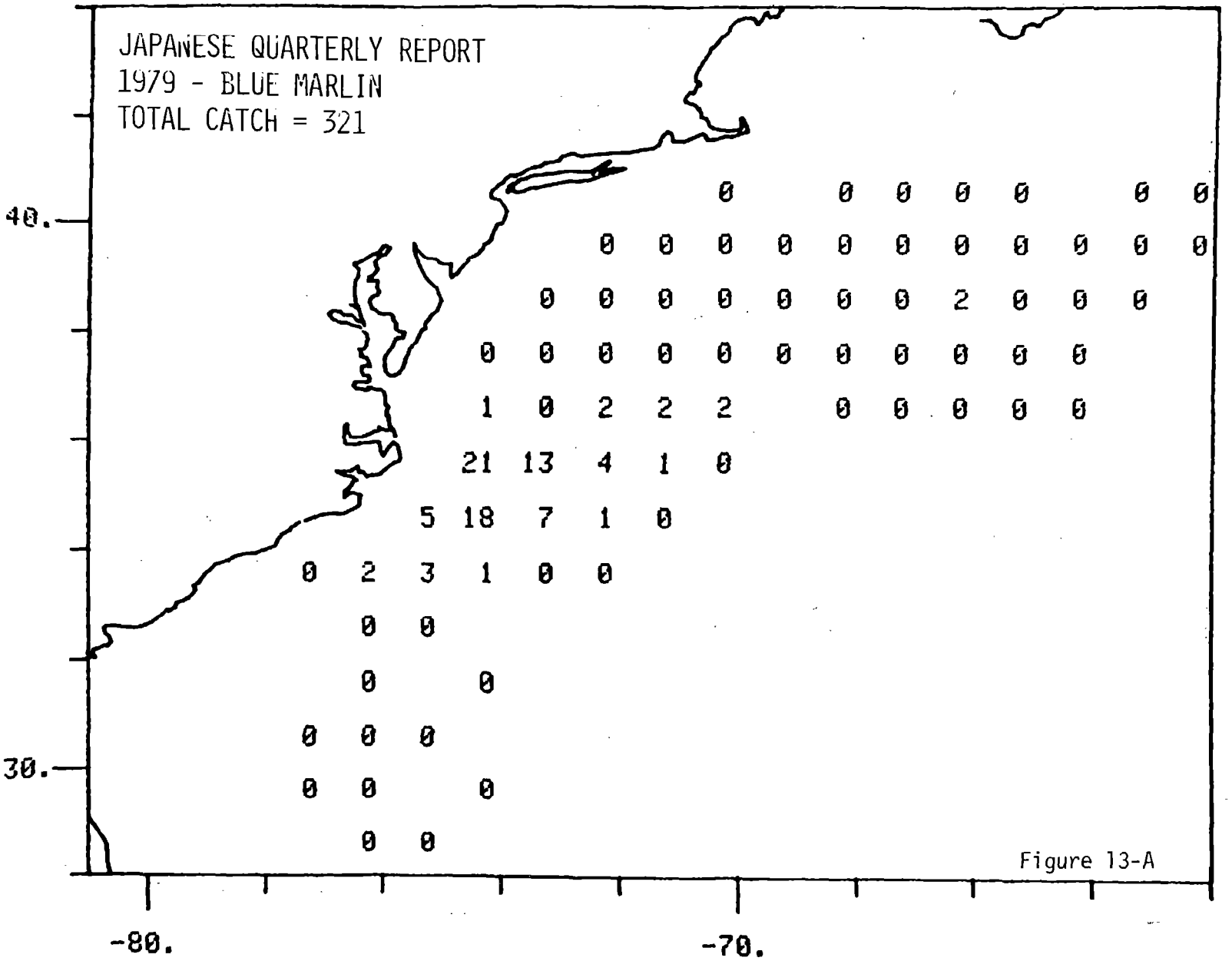

JAPANESE QUARTERLY REPORT
1979 - BLUE MARLIN
TOTAL CATCH = 321
40.
30.
-80.
-70.
0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 2 0 0 0
0 0 0 0 0 0 0 0 0 0 0
1 0 2 2 2 0 0 0 0 0
21 13 4 1 0
5 18 7 1 0
0 2 3 1 0 0
0 0
0 0
0 0 0
0 0 0
0 0

Figure 13-A

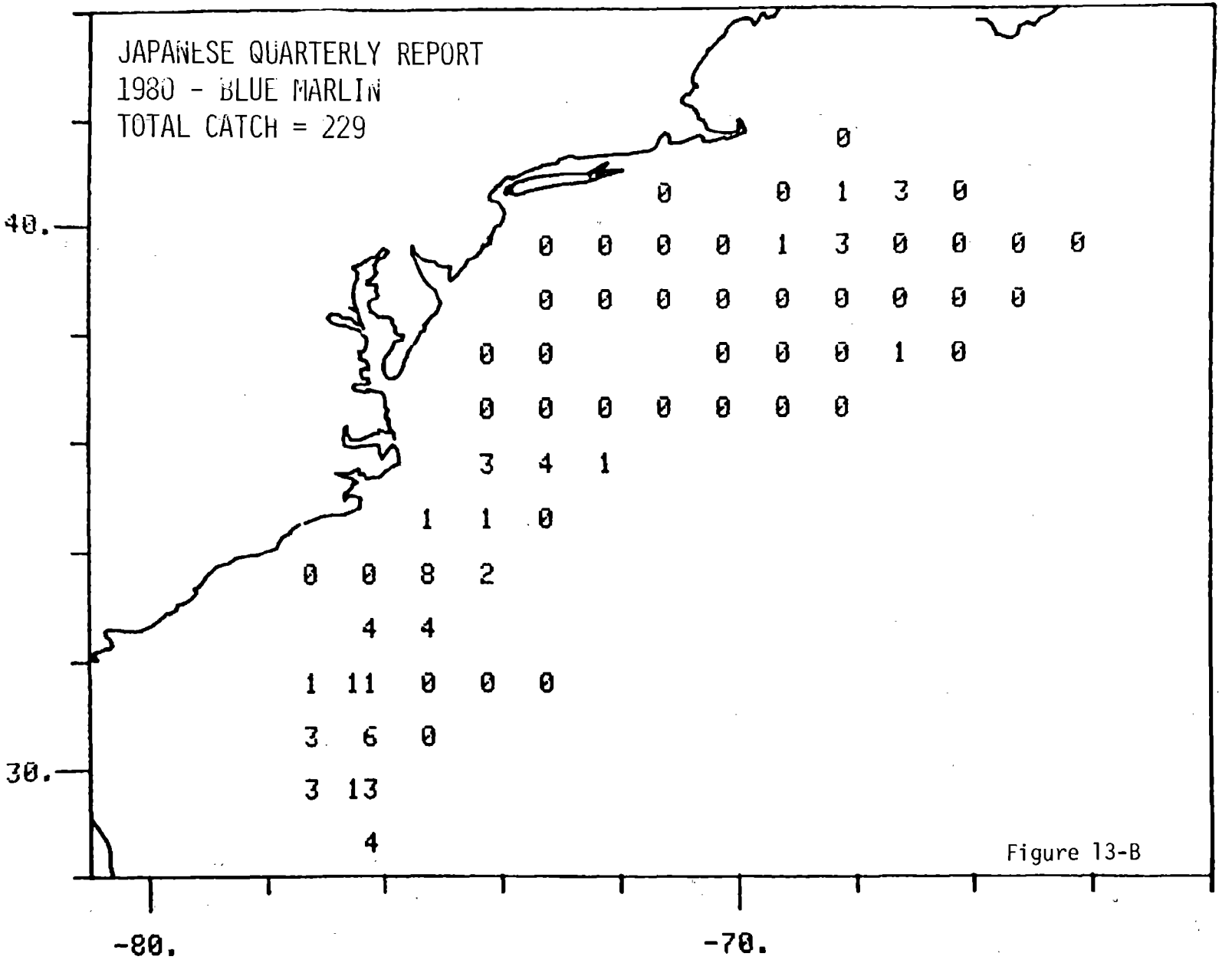
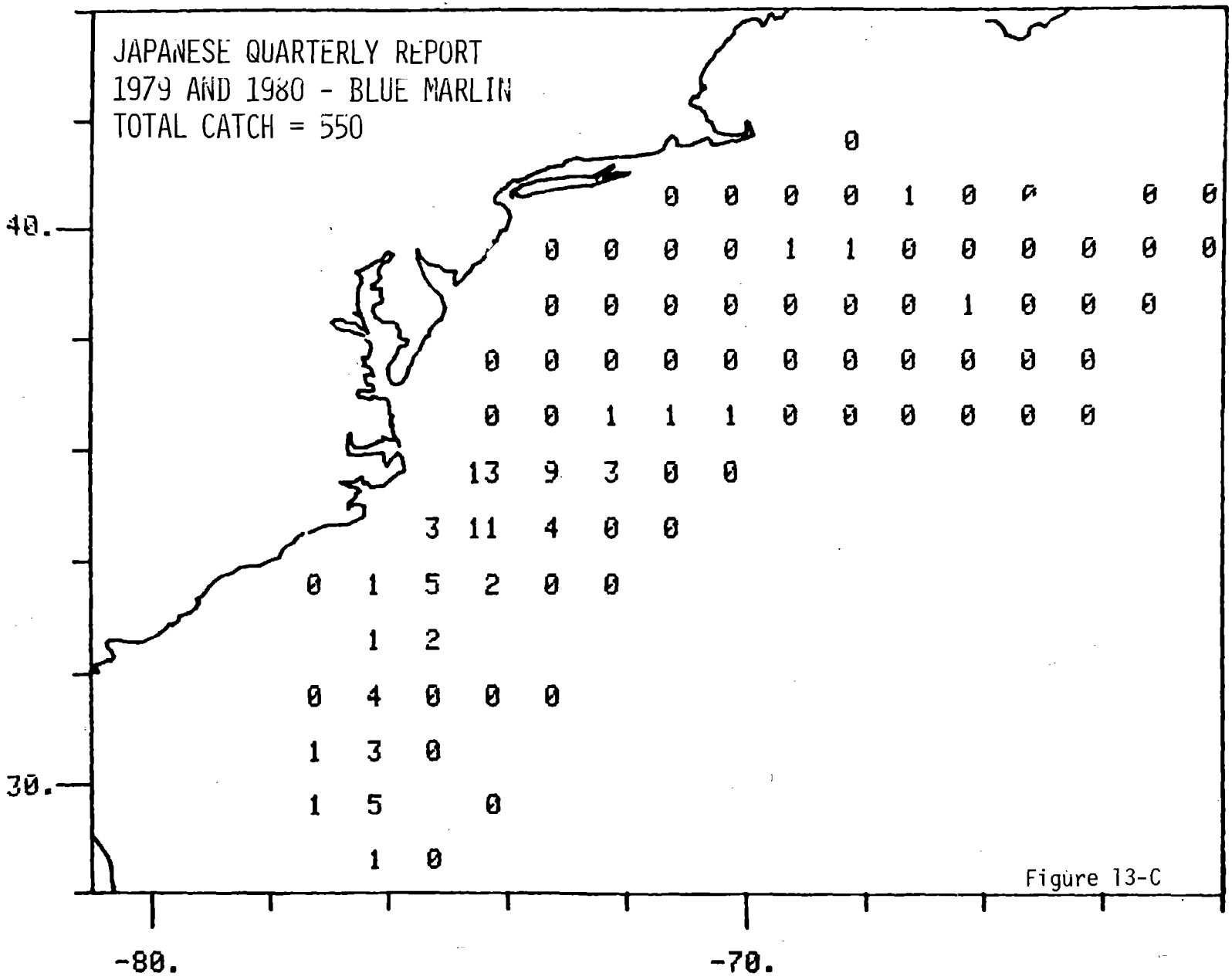

JAPANESE QUARTERLY REPORT
1980 - BLUE MARLIN
TOTAL CATCH = 229
40.
30.
-80.
-70.
0
0 0 1 3 0
0 0 0 0 1 3 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 0
0 0 0 0 0 0 0
3 4 1
1 1 0
0 0 8 2
4 4
1 11 0 0 0
3 6 0
3 13
4

Figure 13-B


JAPANESE QUARTERLY REPORT
1979 AND 1980 - BLUE MARLIN
TOTAL CATCH = 550
40.
30.
-80.
-70.
0
0 0 0 0 1 0 0 0 0
0 0 0 0 1 1 0 0 0 0 0 0
0 0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 1 1 1 0 0 0 0 0 0
13 9 3 0 0
3 11 4 0 0
0 1 5 2 0 0
1 2
0 4 0 0 0
1 3 0
1 5 0
1 0
Figure 13-C

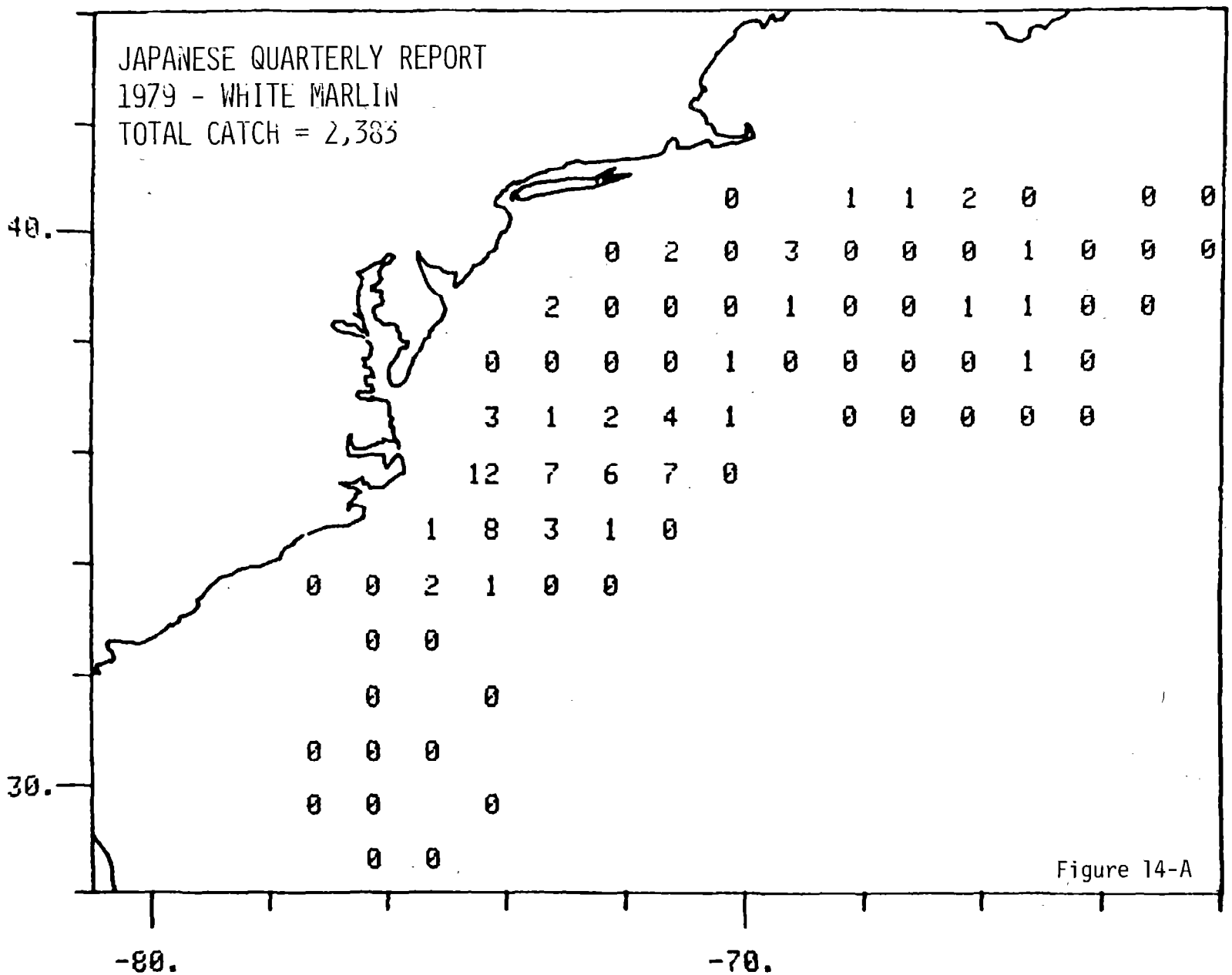

JAPANESE QUARTERLY REPORT
1979 - WHITE MARLIN
TOTAL CATCH = 2,383
40.
30.
-80.
-70.
0 1 1 2 0 0 0
0 2 0 3 0 0 0 1 0 0 0
2 0 0 0 1 0 0 1 1 0 0
0 0 0 0 1 0 0 0 0 1 0
3 1 2 4 1 0 0 0 0 0
12 7 6 7 0
1 8 3 1 0
0 0 2 1 0 0
0 0
0 0
0 0 0
0 0 0
0 0

Figure 14-A

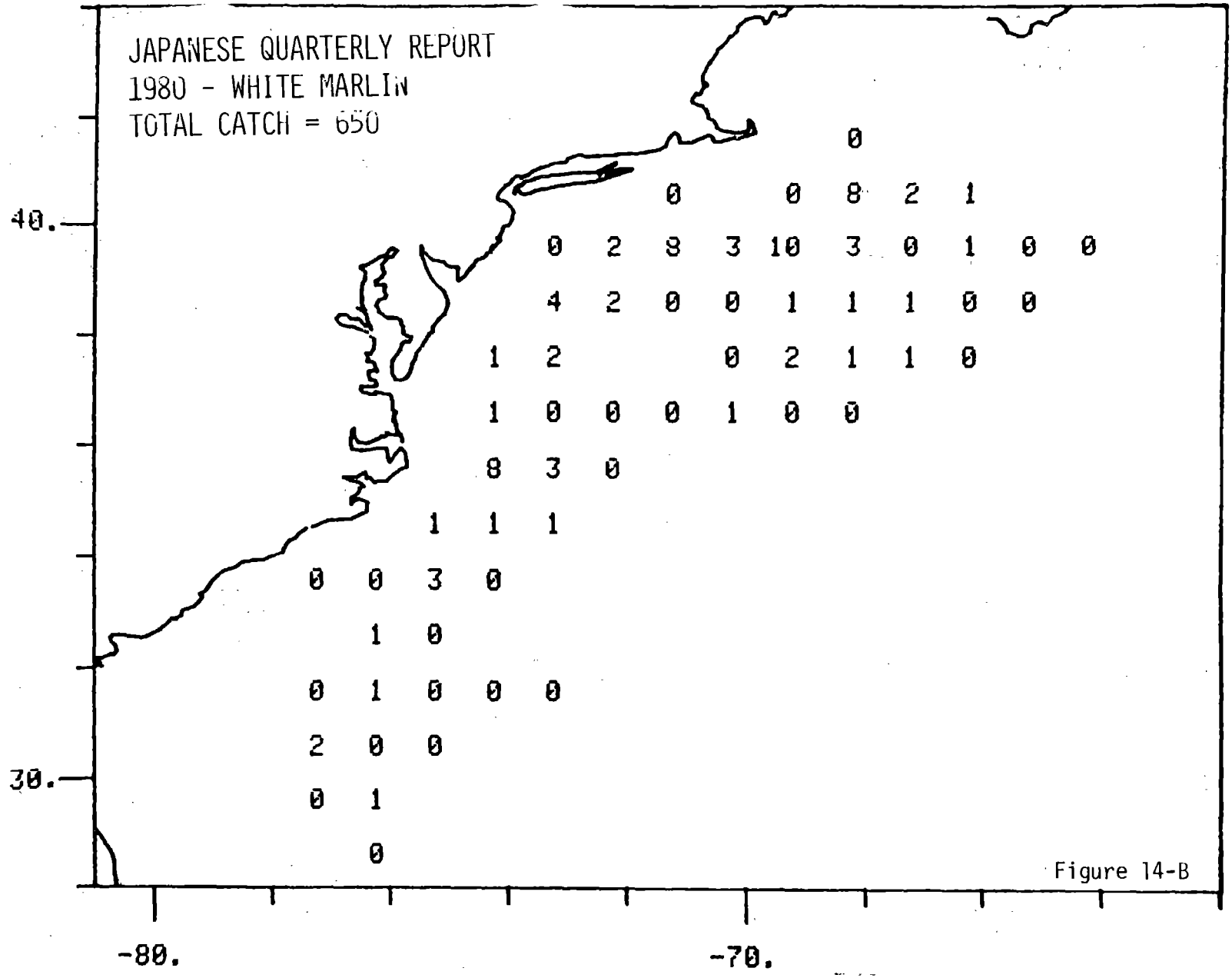
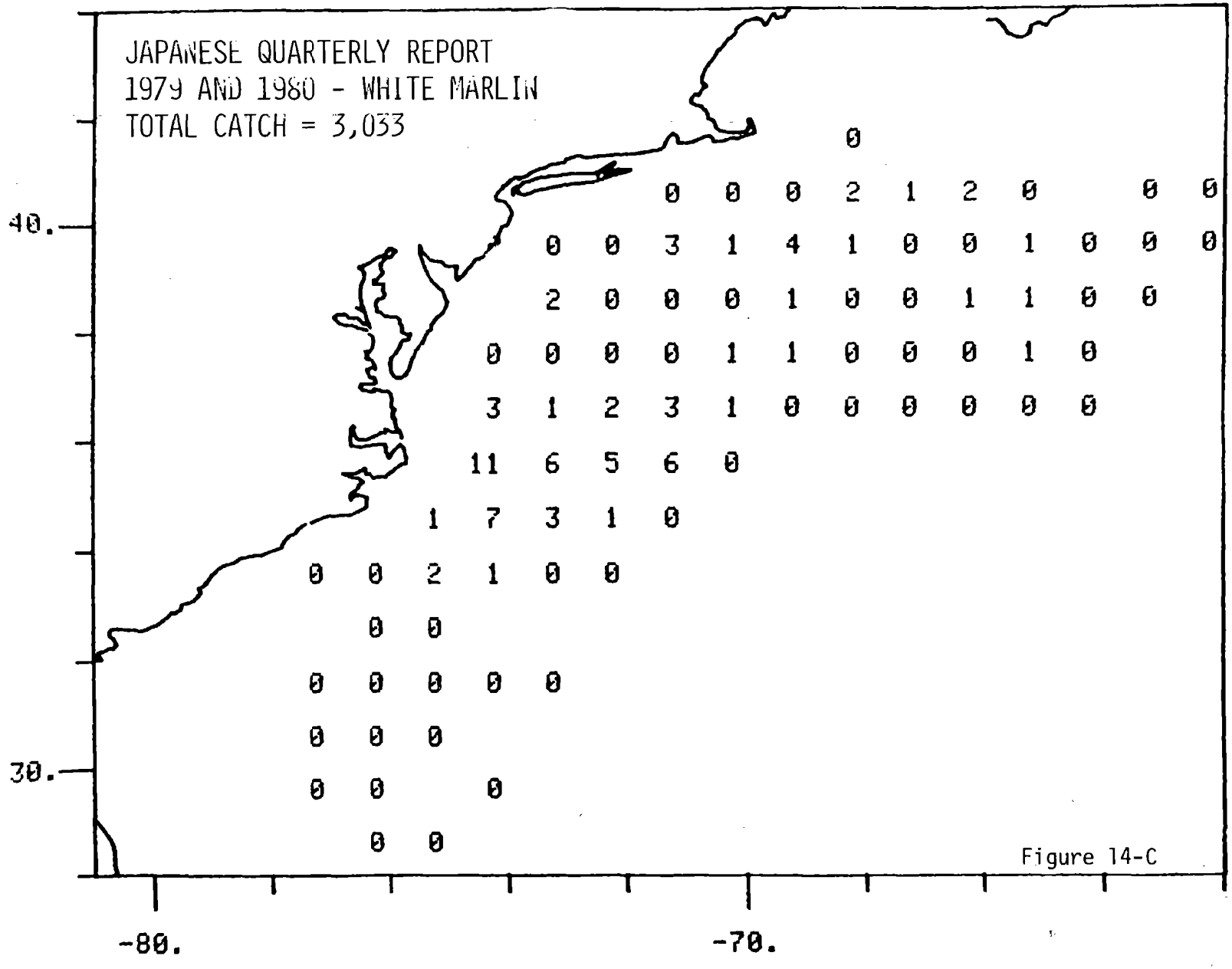

JAPANESE QUARTERLY REPORT
1980 - WHITE MARLIN
TOTAL CATCH = 650
40.
30.
-80.
-70.
0
0 0 8 2 1
0 2 8 3 10 3 0 1 0 0
4 2 0 0 1 1 1 0 0
1 2 0 2 1 1 0
1 0 0 0 1 0 0
8 3 0
1 1 1
0 0 3 0
1 0
0 1 0 0 0
2 0 0
0 1
0

Figure 14-B


JAPANESE QUARTERLY REPORT
1979 AND 1980 - WHITE MARLIN
TOTAL CATCH = 3,033
40.
30.
-80.
-70.
0
0 0 0 2 1 2 0 0 0
0 0 3 1 4 1 0 0 1 0 0 0
2 0 0 0 1 0 0 1 1 0 0
0 0 0 0 1 1 0 0 0 1 0
3 1 2 3 1 0 0 0 0 0 0
11 6 5 6 0
1 7 3 1 0
0 0 2 1 0 0
0 0
0 0 0 0 0
0 0 0
0 0 0
0 0
Figure 14-C

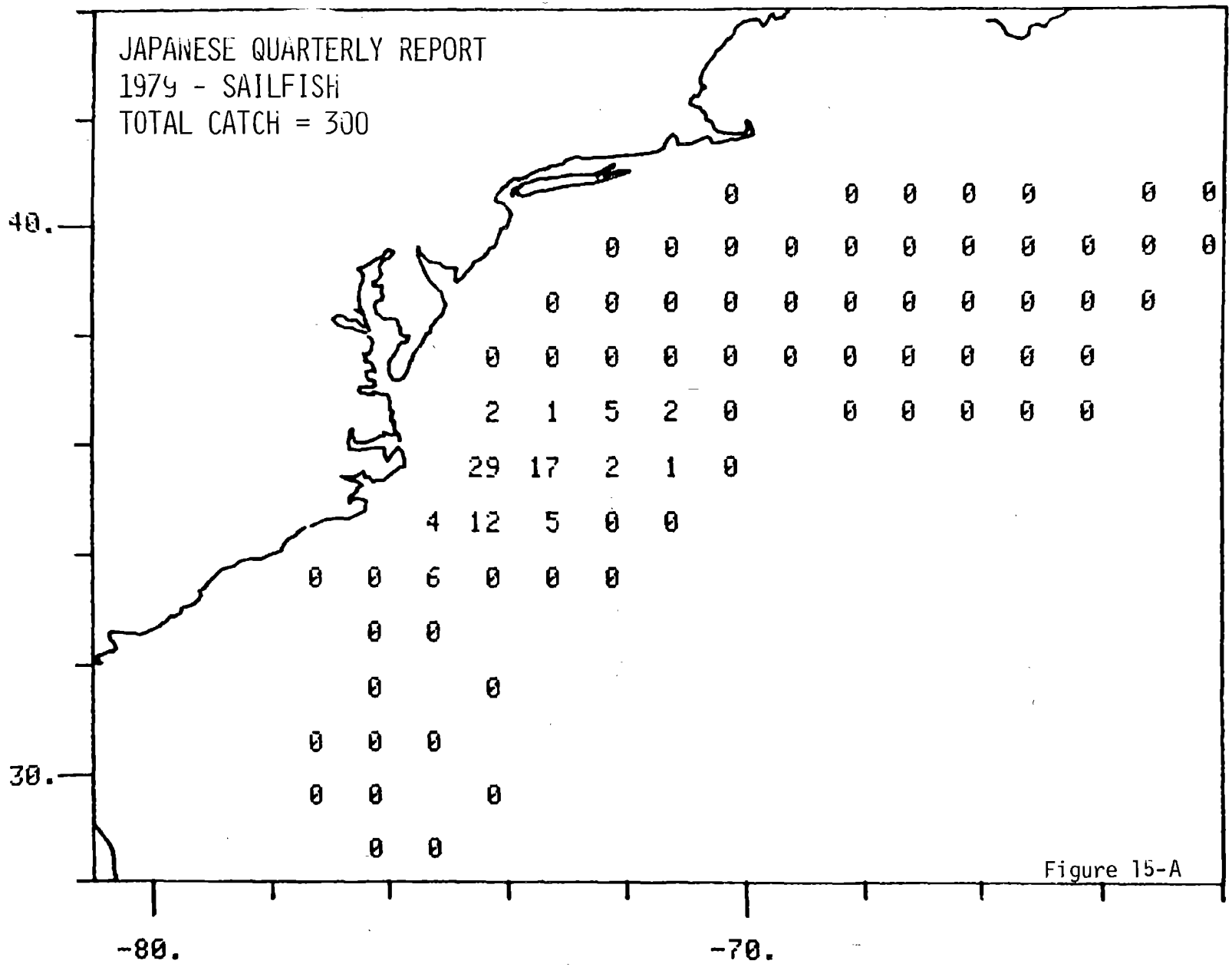

JAPANESE QUARTERLY REPORT
1979 - SAILFISH
TOTAL CATCH = 300
40.
30.
-80.
-70.

Figure 15-A

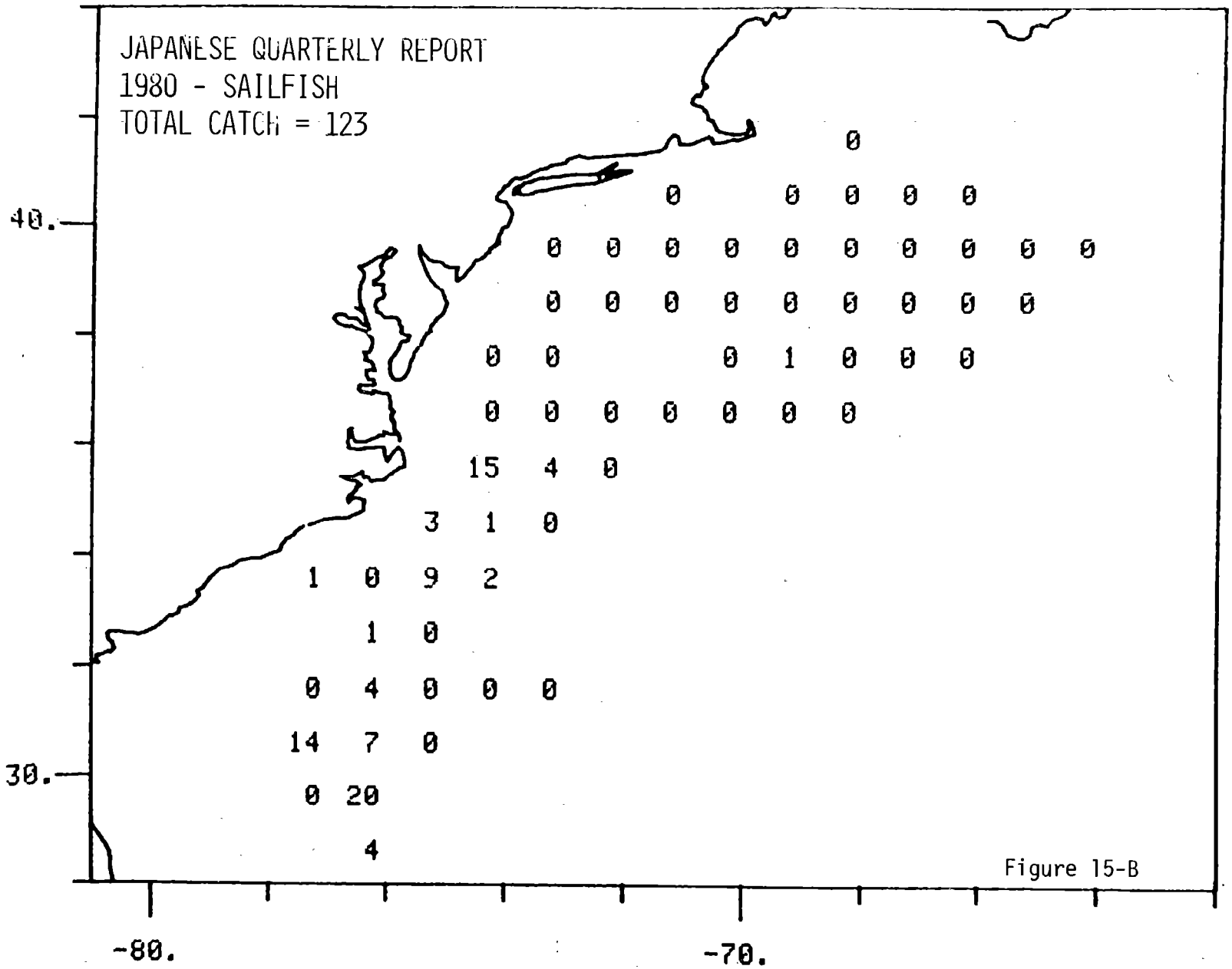

JAPANESE QUARTERLY REPORT
1980 - SAILFISH
TOTAL CATCH = 123
40.
30.
-80.
-70.

Figure 15-B

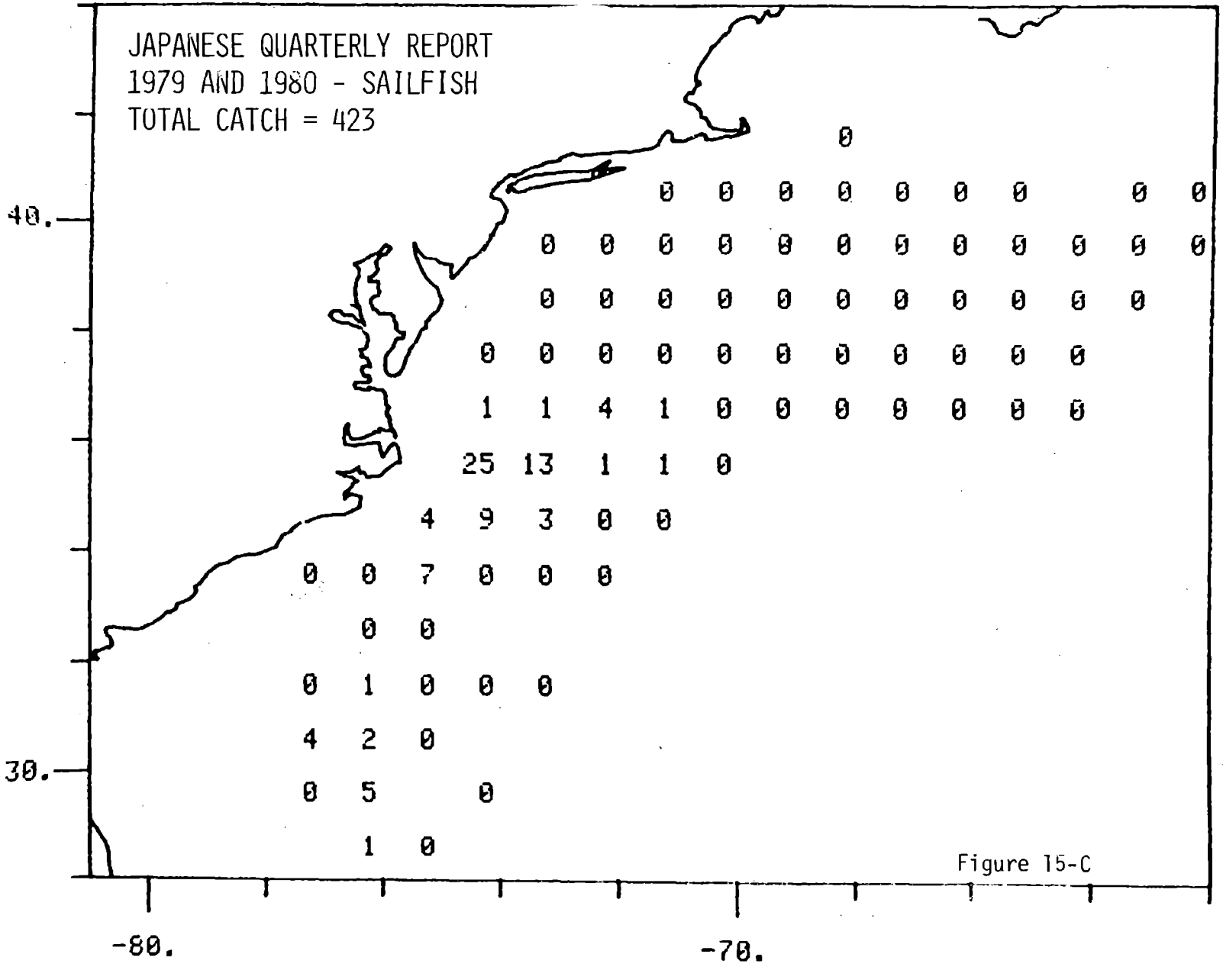

JAPANESE QUARTERLY REPORT
1979 AND 1980 - SAILFISH
TOTAL CATCH = 423
40.
30.
-80.
-70.

Figure 15-C

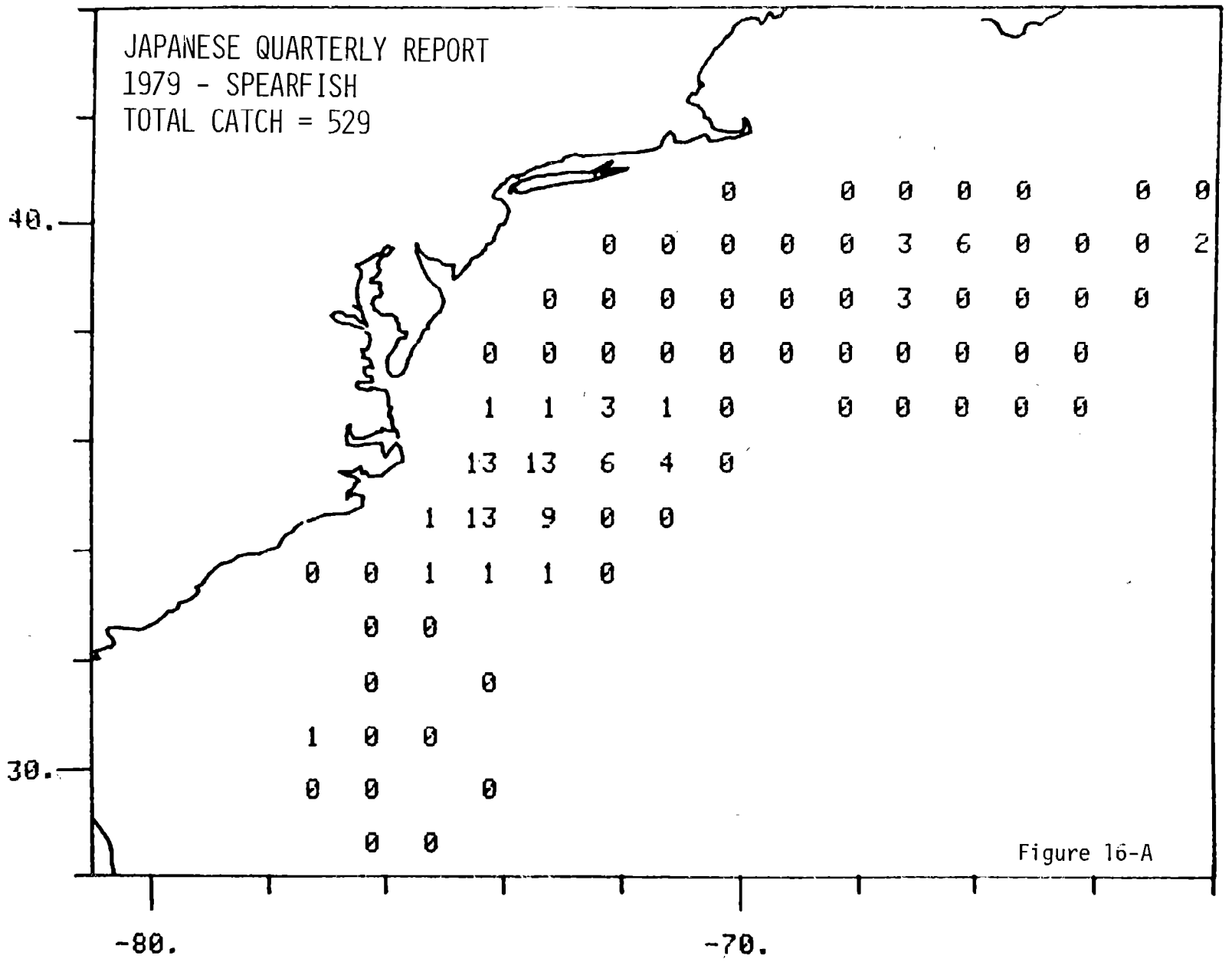

JAPANESE QUARTERLY REPORT
1979 - SPEARFISH
TOTAL CATCH = 529
40.
30.
-80.
-70.
0 0 0 0 0 0 0
0 0 0 0 0 3 6 0 0 0 2
0 0 0 0 0 0 3 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
1 1 3 1 0 0 0 0 0 0 0
13 13 6 4 0
1 13 9 0 0
0 0 1 1 1 0
0 0
0 0
1 0 0
0 0 0
0 0

Figure 16-A

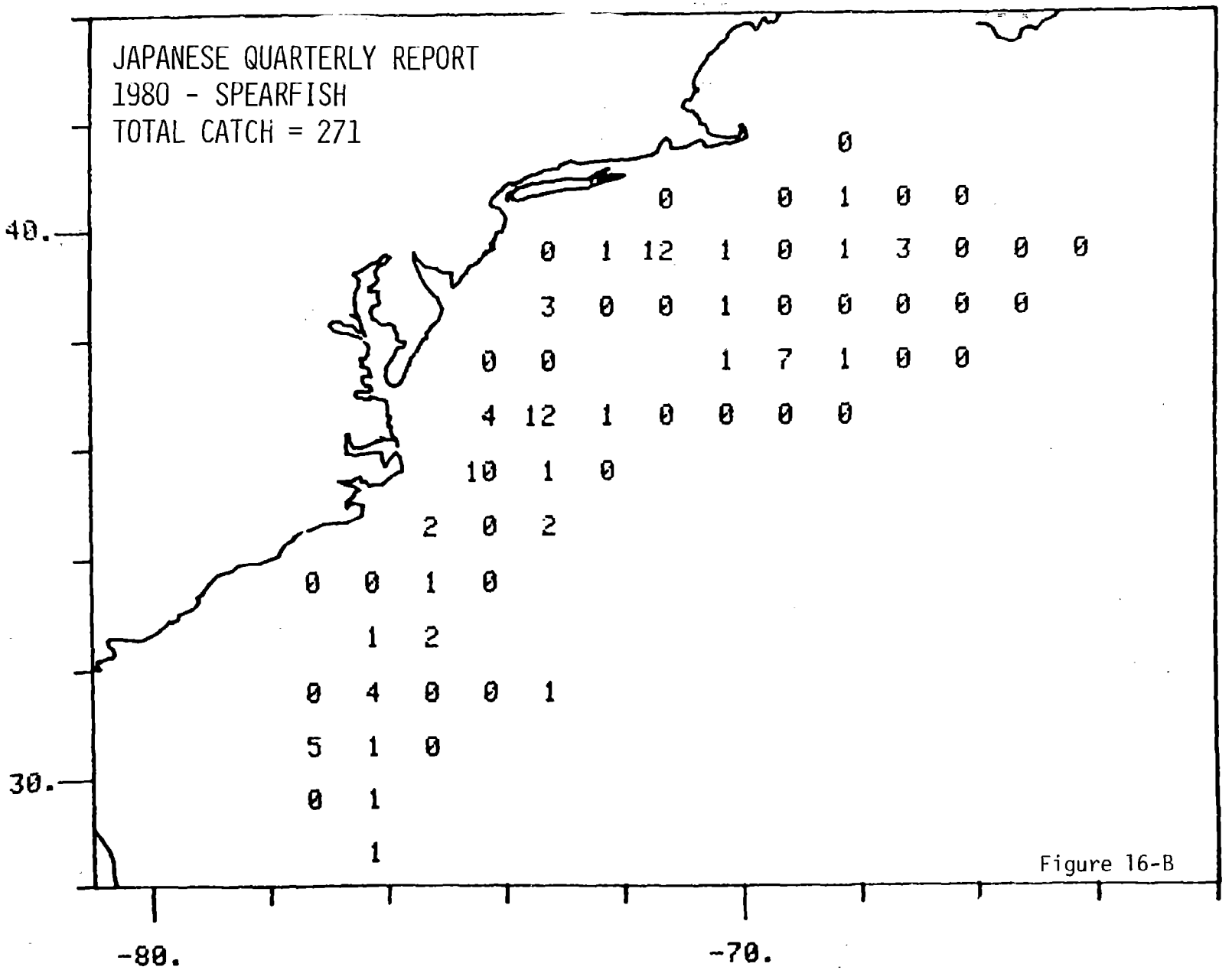

JAPANESE QUARTERLY REPORT
1980 - SPEARFISH
TOTAL CATCH = 271
40.
30.
-80.
-70.
0
0 0 1 0 0
0 1 12 1 0 1 3 0 0 0
3 0 0 1 0 0 0 0 0
0 0 1 7 1 0 0
4 12 1 0 0 0 0
10 1 0
2 0 2
0 0 1 0
1 2
0 4 0 0 1
5 1 0
0 1
1

Figure 16-B

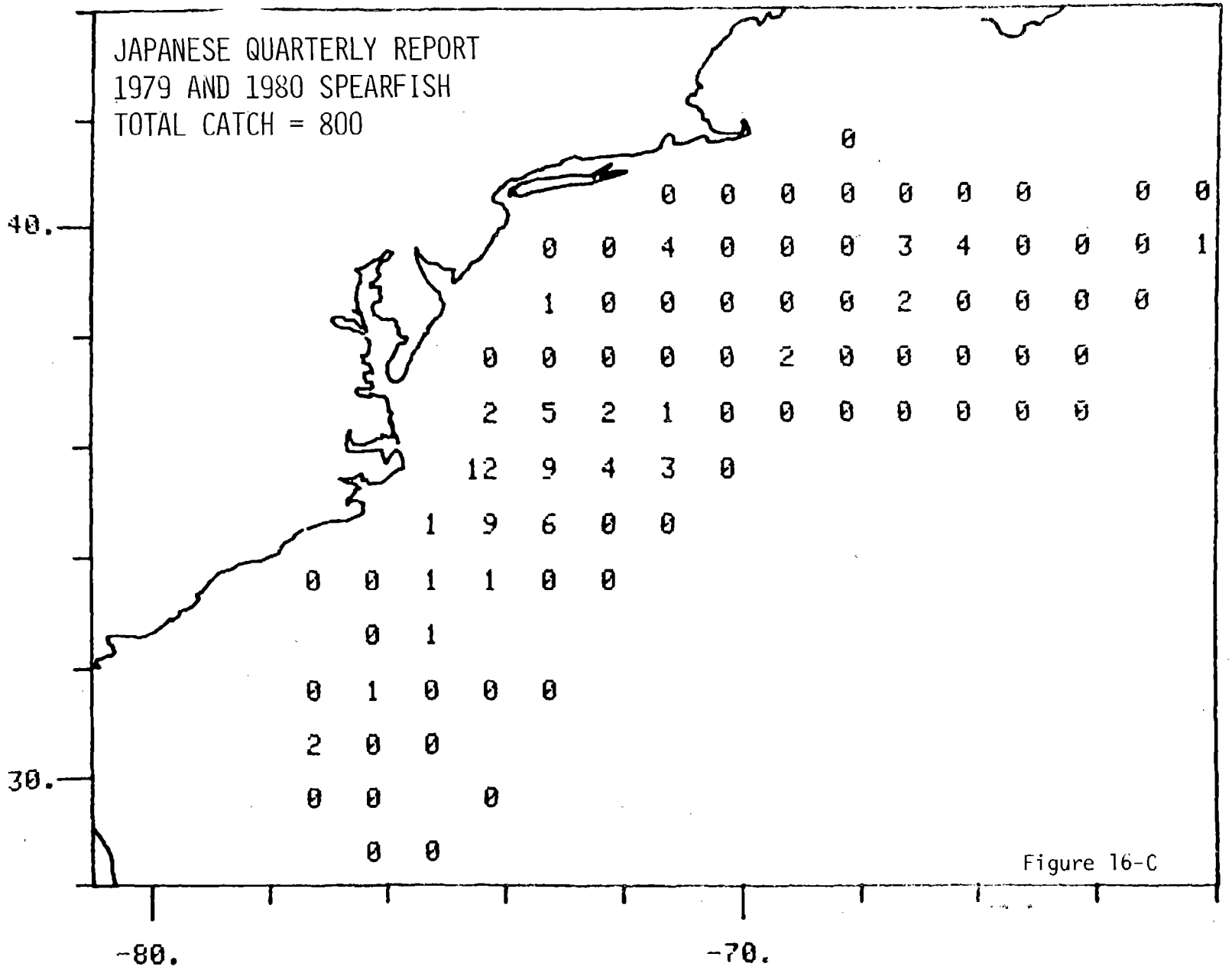

JAPANESE QUARTERLY REPORT
1979 AND 1980 SPEARFISH
TOTAL CATCH = 800
40.
30.
-80.
-70.
0
0 0 0 0 0 0 0 0 0
0 0 4 0 0 0 3 4 0 0 0 1
1 0 0 0 0 0 2 0 0 0 0
0 0 0 0 0 2 0 0 0 0 0
2 5 2 1 0 0 0 0 0 0 0
12 9 4 3 0
1 9 6 0 0
0 0 1 1 0 0
0 1
0 1 0 0 0
2 0 0
0 0 0
0 0

Figure 16-C

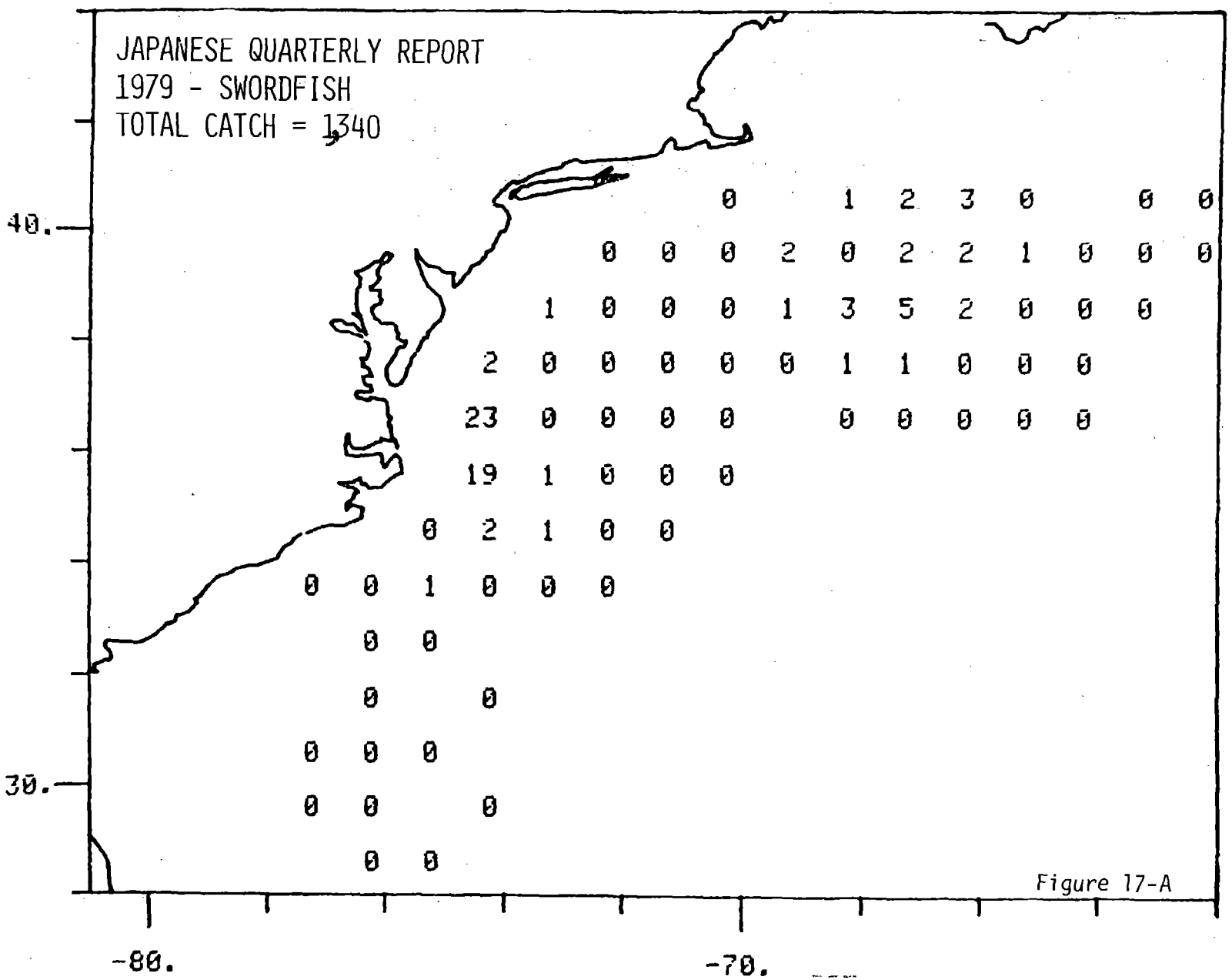

JAPANESE QUARTERLY REPORT
1979 - SWORDFISH
TOTAL CATCH = 1340
40.
30.
-80.
-70.
0 1 2 3 0 0 0
0 0 0 2 0 2 2 1 0 0 0
1 0 0 0 1 3 5 2 0 0 0
2 0 0 0 0 0 1 1 0 0 0
23 0 0 0 0 0 0 0 0 0
19 1 0 0 0
0 2 1 0 0
0 0 1 0 0 0
0 0
0 0
0 0 0
0 0 0
0 0

Figure 17-A

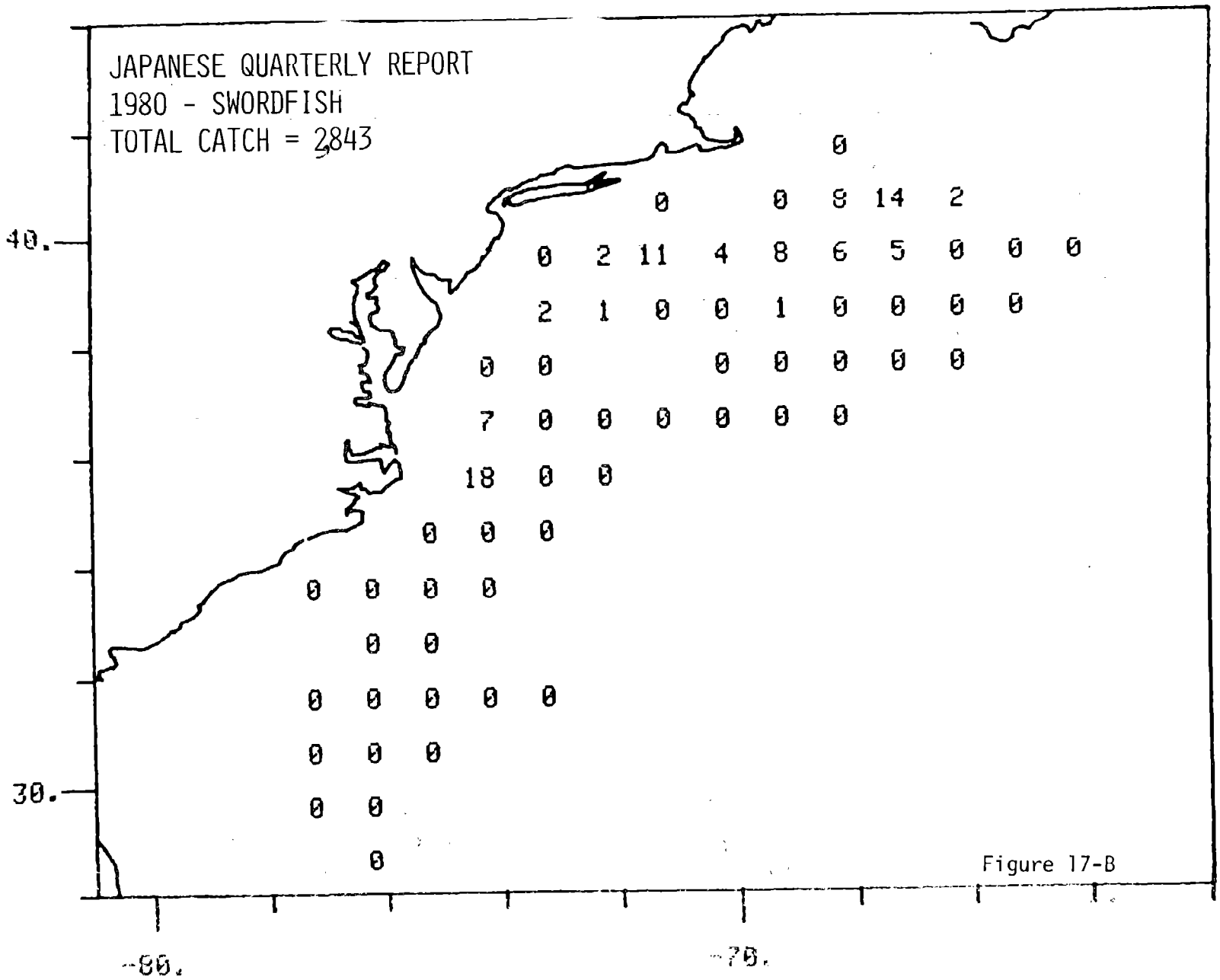

JAPANESE QUARTERLY REPORT
1980 - SWORDFISH
TOTAL CATCH = 2843
40.
30.
-80.
-70.
0
0 0 8 14 2
0 2 11 4 8 6 5 0 0 0
2 1 0 0 1 0 0 0 0
0 0 0 0 0 0 0
7 0 0 0 0 0 0
18 0 0
0 0 0
0 0 0 0
0 0
0 0 0 0 0
0 0 0
0 0
0

Figure 17-B

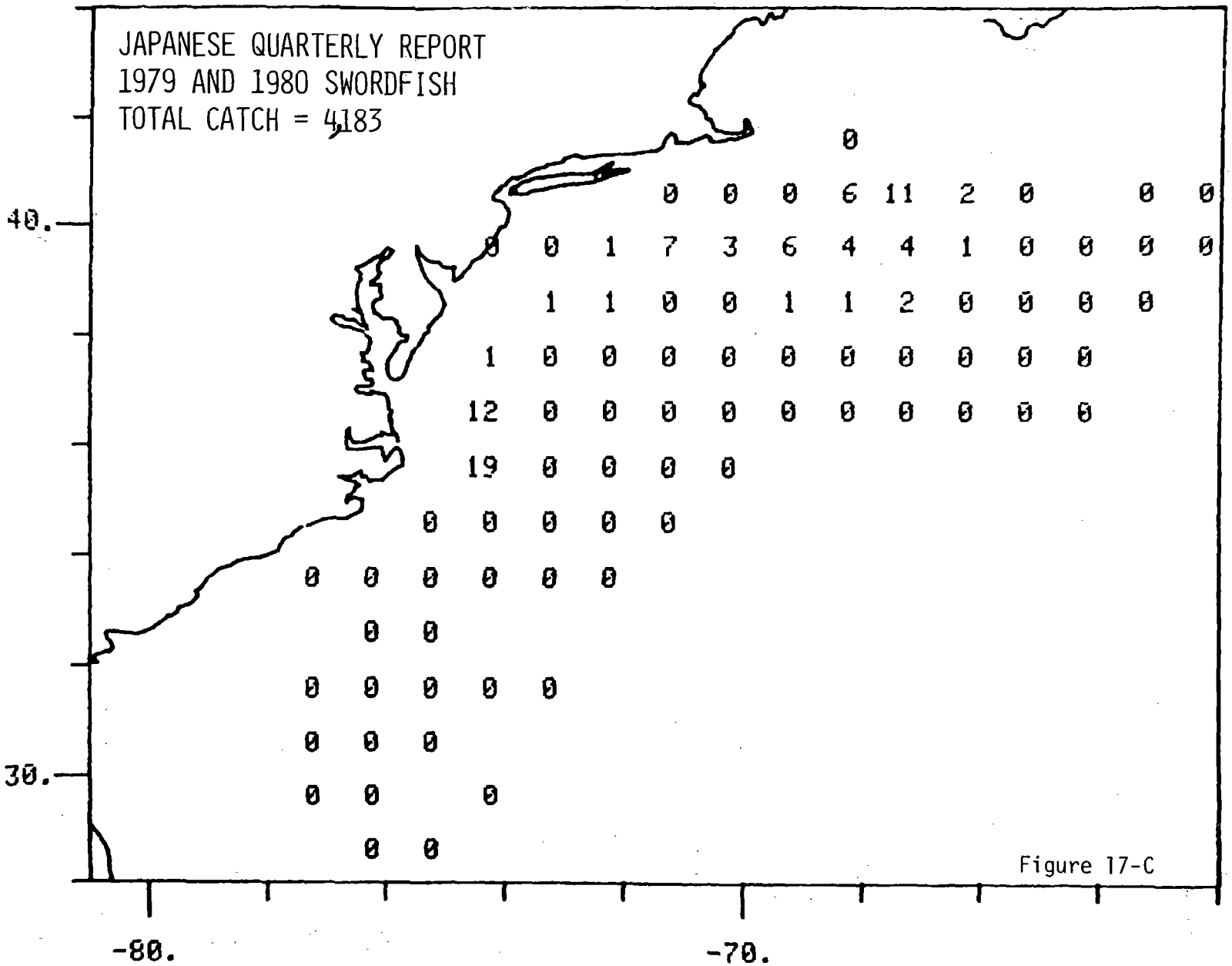

JAPANESE QUARTERLY REPORT
1979 AND 1980 SWORDFISH
TOTAL CATCH = 4,183
40.
30.
-80.
-70.
0
0 0 0 6 11 2 0 0 0
0 0 1 7 3 6 4 4 1 0 0 0 0
1 1 0 0 1 1 2 0 0 0 0
1 0 0 0 0 0 0 0 0 0 0
12 0 0 0 0 0 0 0 0 0 0
19 0 0 0 0
0 0 0 0 0
0 0 0 0 0 0
0 0
0 0 0 0 0
0 0 0
0 0 0
0 0

Figure 17-C

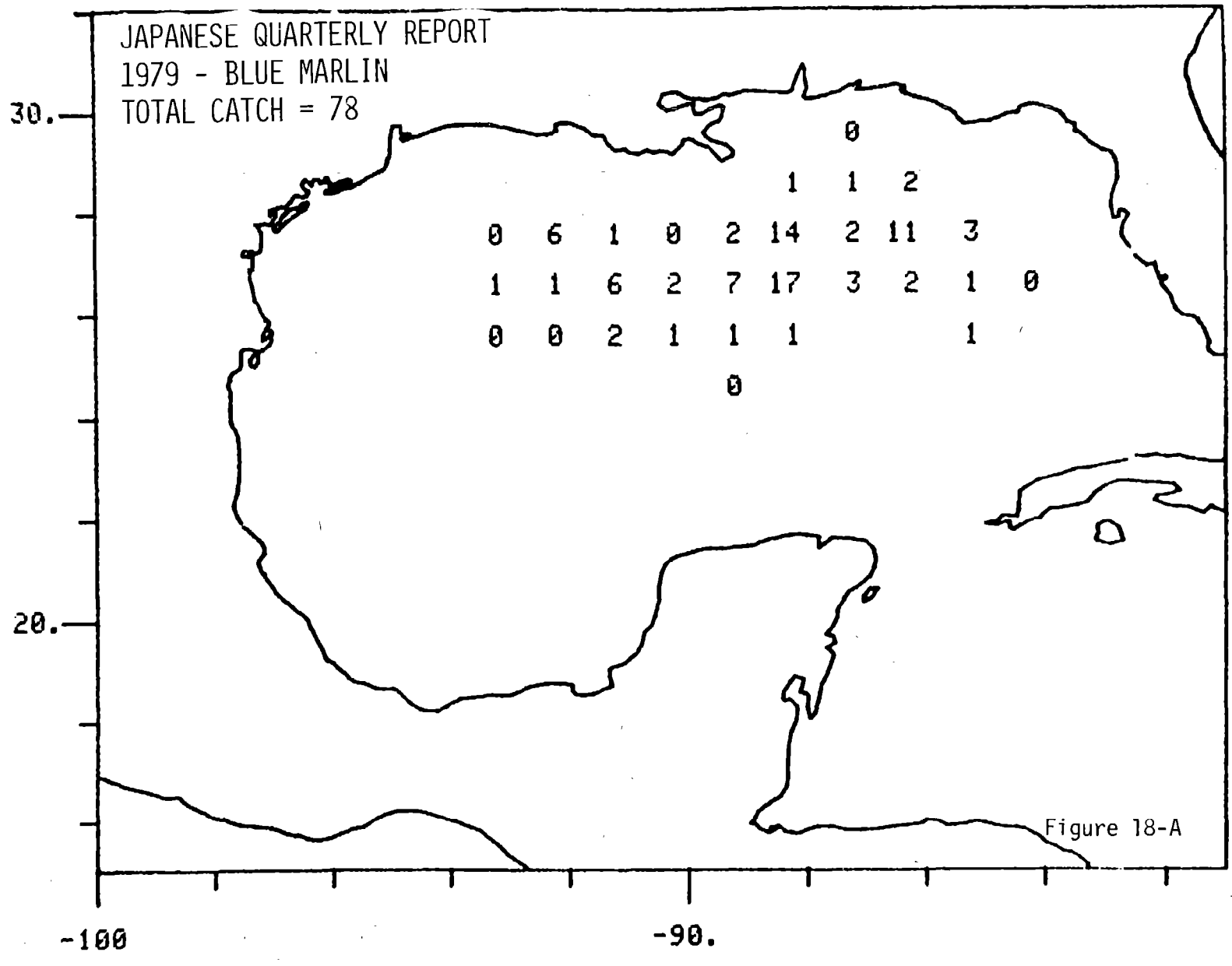

JAPANESE QUARTERLY REPORT
1979 - BLUE MARLIN
TOTAL CATCH = 78
30.
20.
-100
-90.
0
1 1 2
0 6 1 0 2 14 2 11 3
1 1 6 2 7 17 3 2 1 0
0 0 2 1 1 1 1
0

Figure 18-A

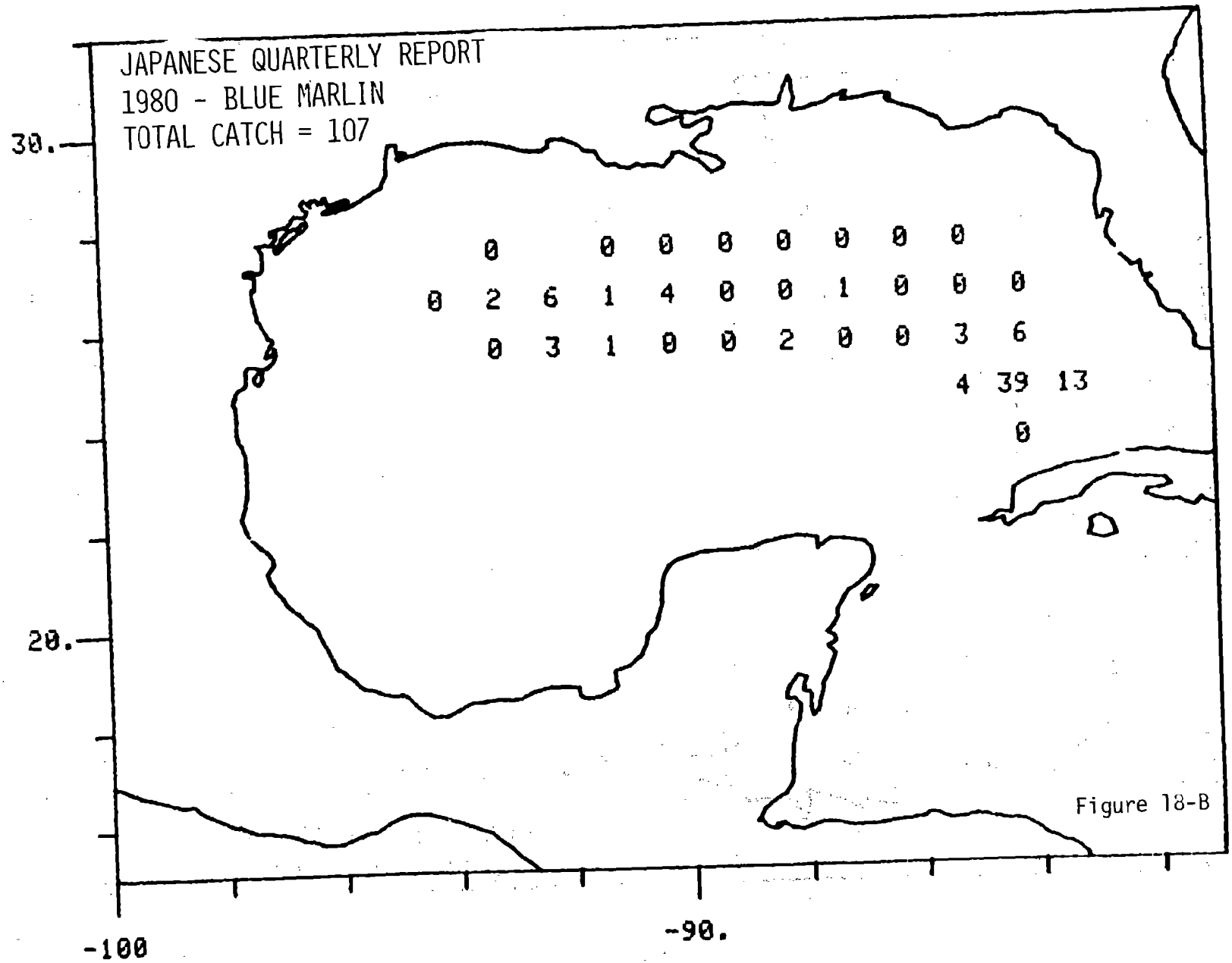

JAPANESE QUARTERLY REPORT
1980 - BLUE MARLIN
TOTAL CATCH = 107
30.
20.
-100
-90.
0 0 0 0 0 0 0
0 2 6 1 4 0 0 1 0 0 0
0 3 1 0 0 2 0 0 3 6
4 39 13
0

Figure 18-B

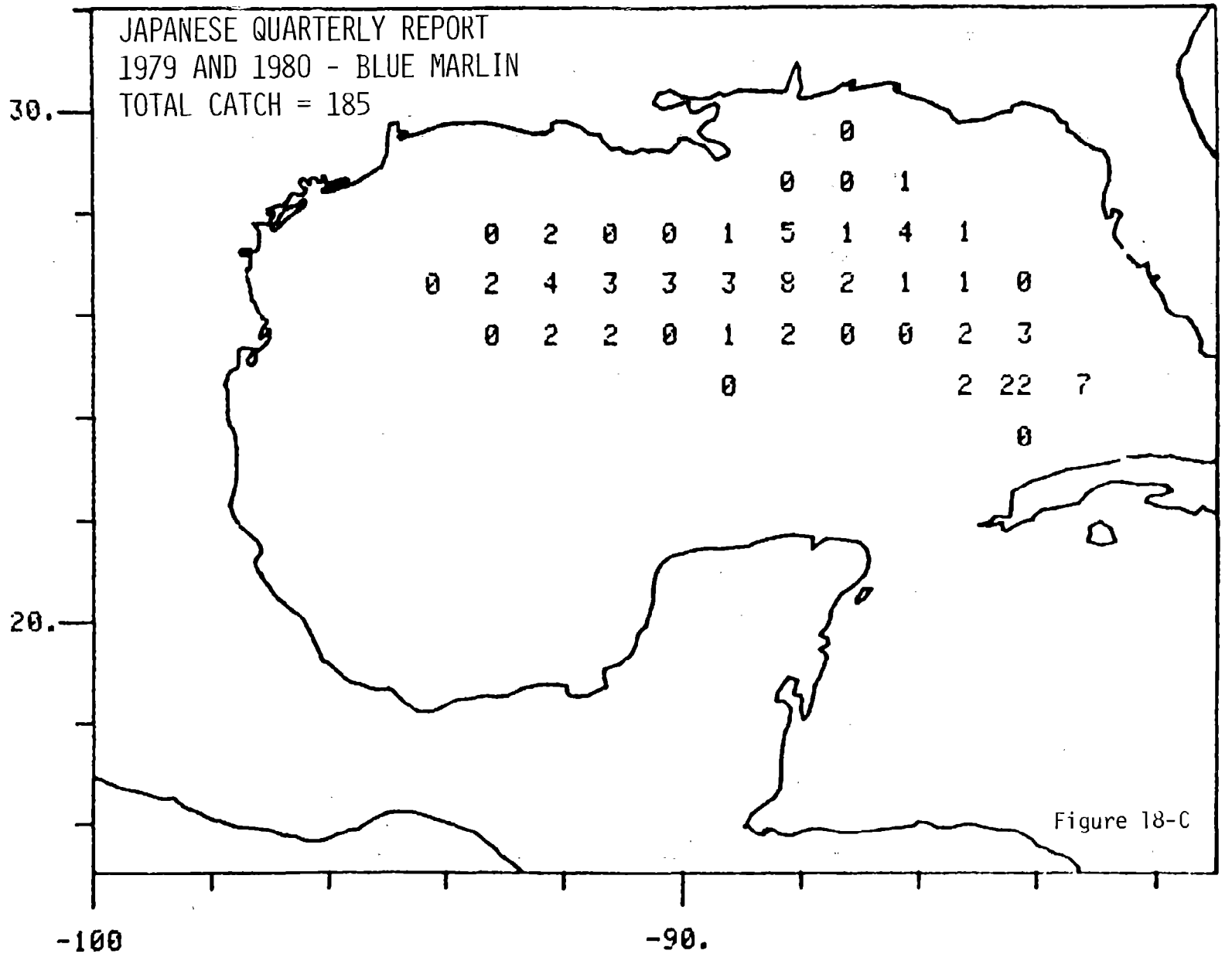

JAPANESE QUARTERLY REPORT
1979 AND 1980 - BLUE MARLIN
TOTAL CATCH = 185
30.
20.
-100
-90.
0
0 0 1
0 2 0 0 1 5 1 4 1
0 2 4 3 3 3 8 2 1 1 0
0 2 2 0 1 2 0 0 2 3
0 2 22 7
0

Figure 18-C

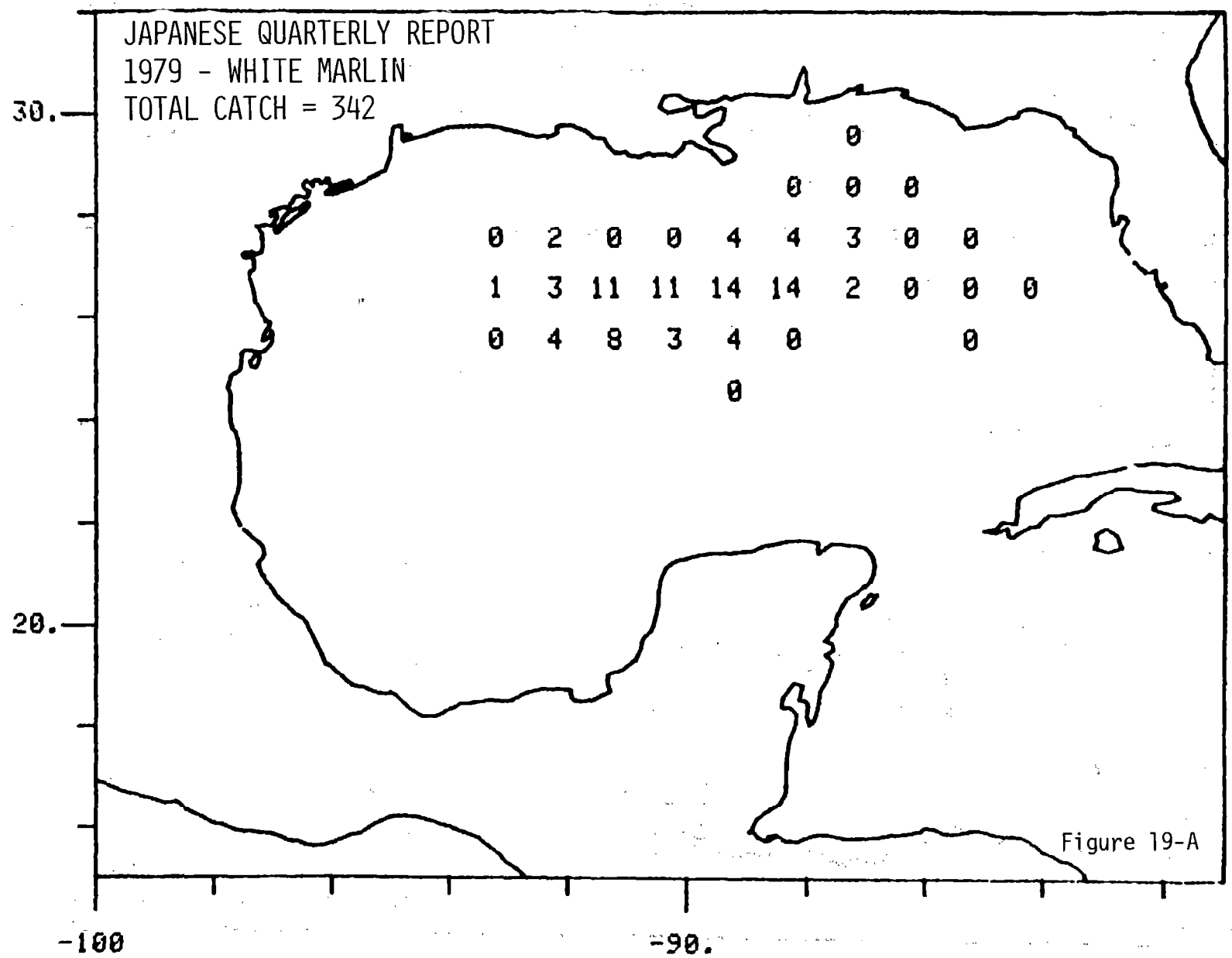

JAPANESE QUARTERLY REPORT
1979 - WHITE MARLIN
TOTAL CATCH = 342
30.
20.
-100
-90.
0
0 0 0
0 2 0 0 4 4 3 0 0
1 3 11 11 14 14 2 0 0 0
0 4 8 3 4 0 0
0

Figure 19-A

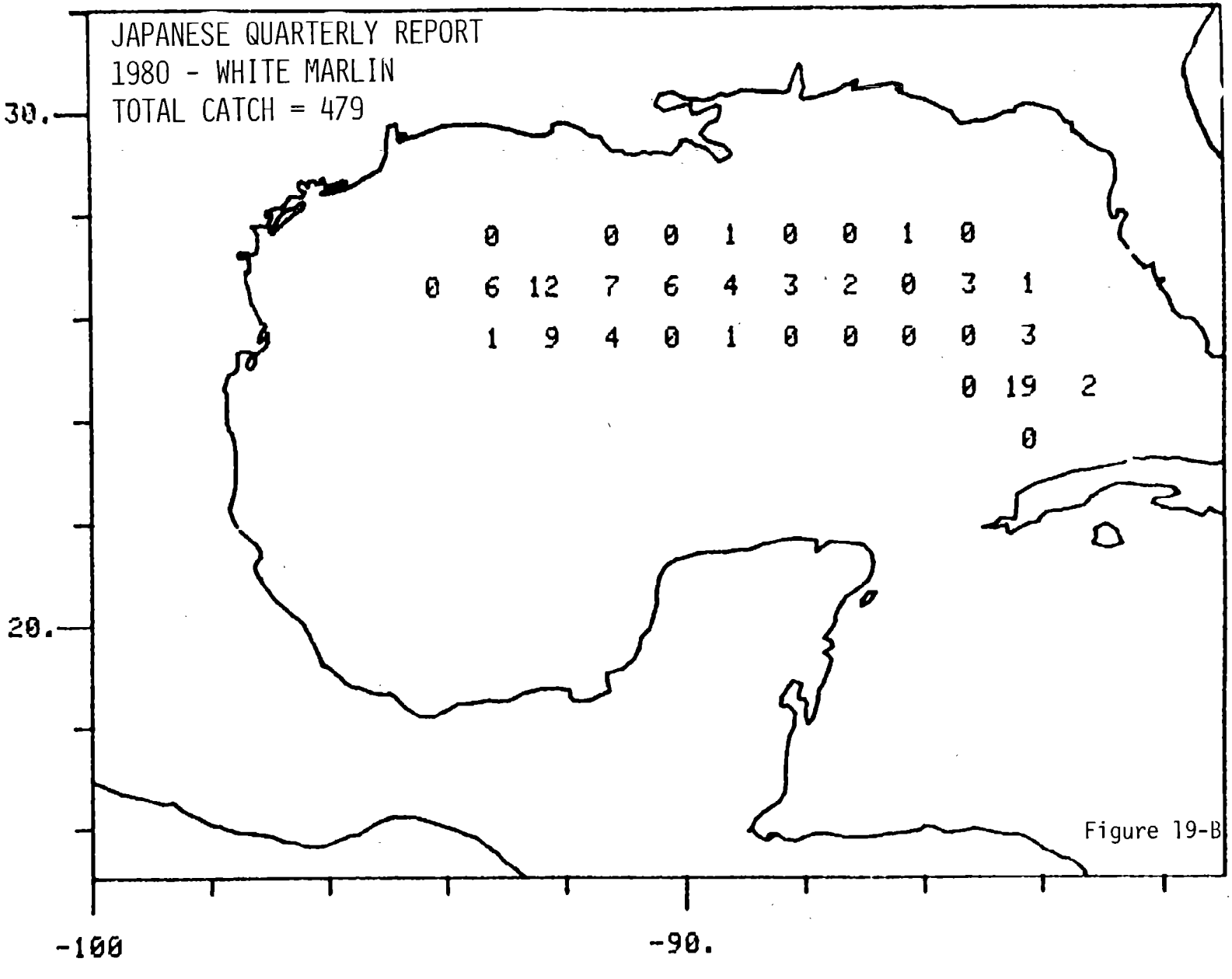

JAPANESE QUARTERLY REPORT
1980 - WHITE MARLIN
TOTAL CATCH = 479
30.
20.
-100
-90.
0 0 0 1 0 0 1 0
0 6 12 7 6 4 3 2 0 3 1
1 9 4 0 1 0 0 0 0 3
0 19 2
0

Figure 19-B

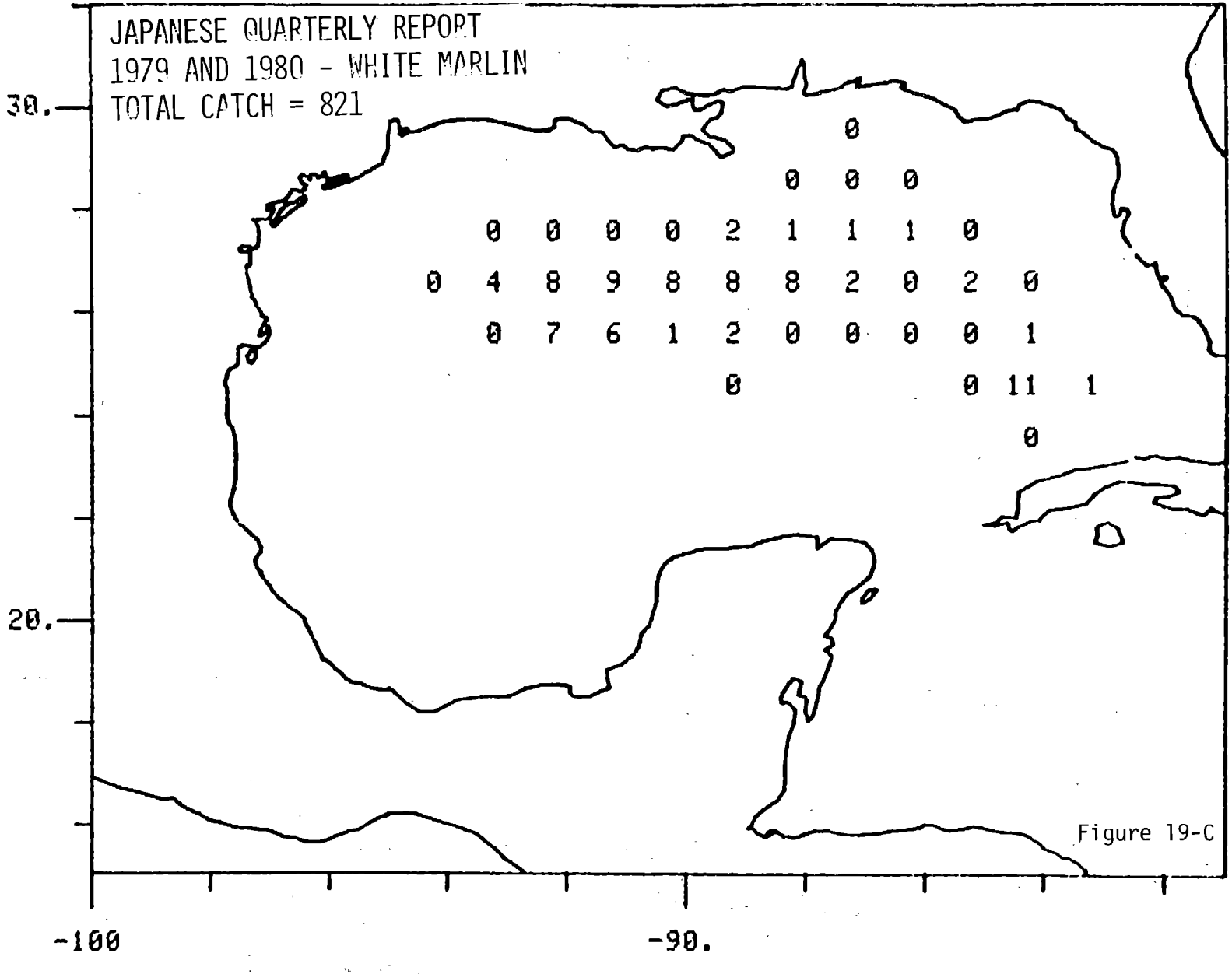

JAPANESE QUARTERLY REPORT
1979 AND 1980 - WHITE MARLIN
TOTAL CATCH = 821
30.
20.
-100
-90.
0
0 0 0
0 0 0 0 2 1 1 1 0
0 4 8 9 8 8 8 2 0 2 0
0 7 6 1 2 0 0 0 0 1
0 0 11 1
0

Figure 19-C

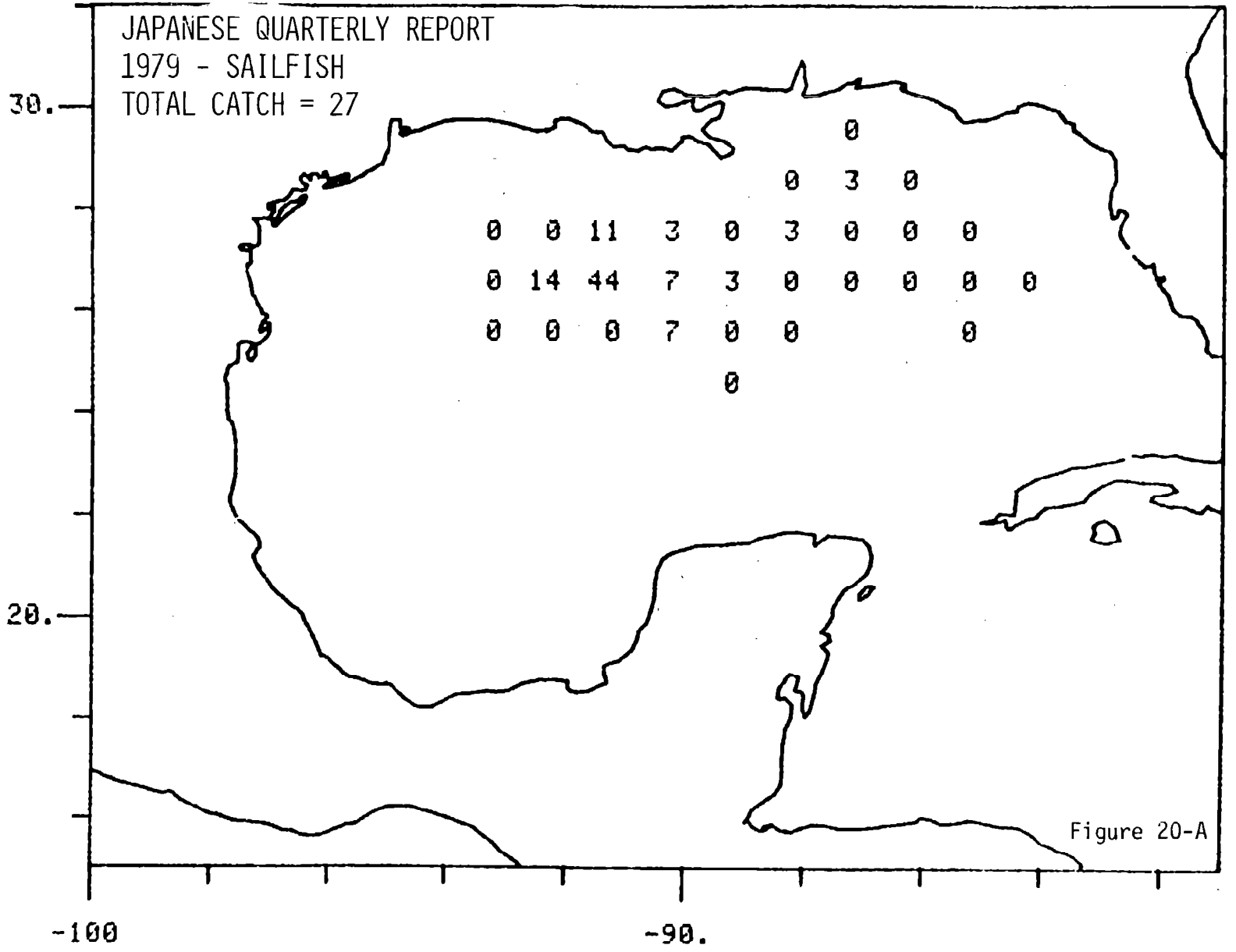

JAPANESE QUARTERLY REPORT
1979 - SAILFISH
TOTAL CATCH = 27
30.
20.
-100
-90.
0
0 3 0
0 0 11 3 0 3 0 0 0
0 14 44 7 3 0 0 0 0 0
0 0 0 7 0 0 0
0

Figure 20-A

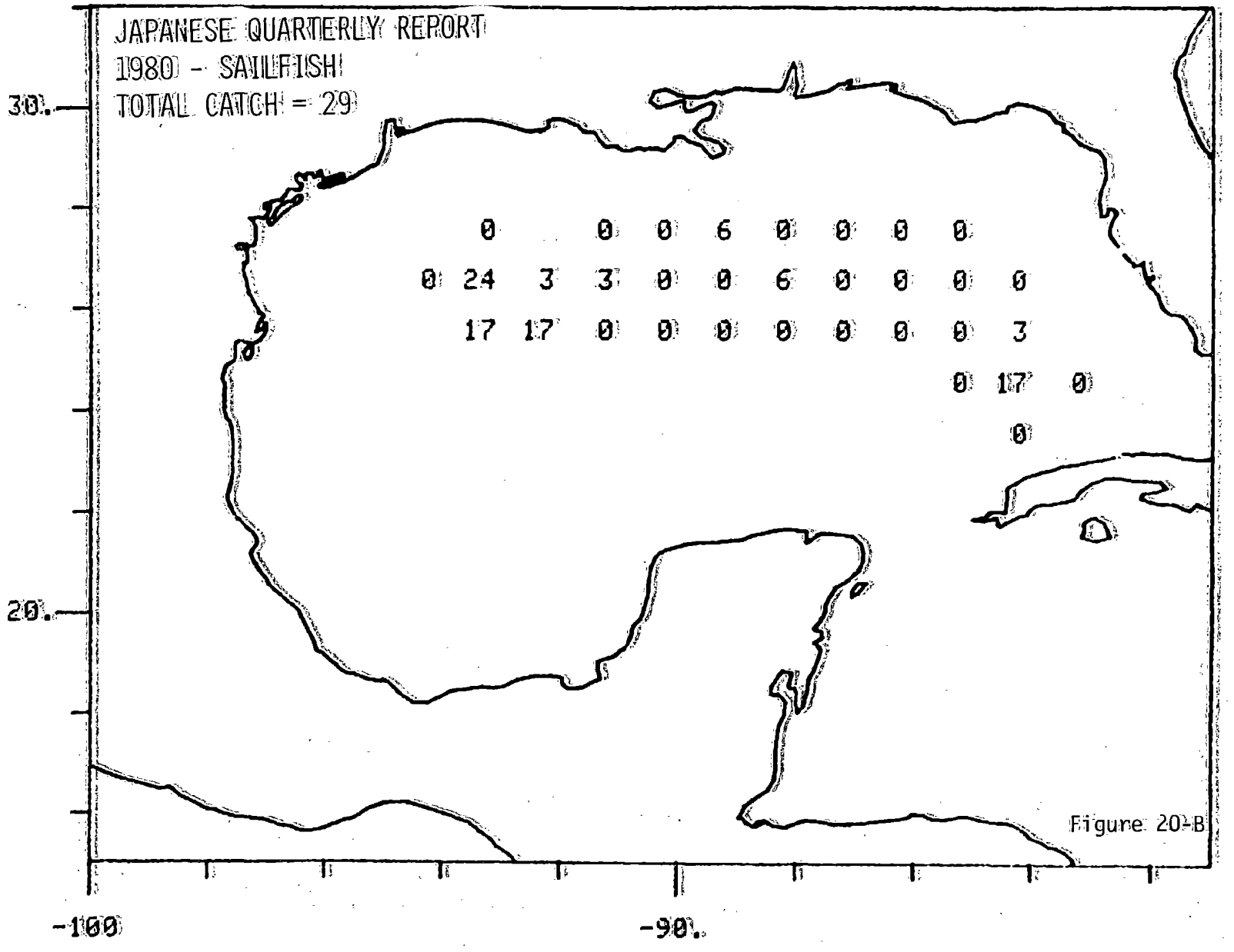

JAPANESE QUARTERLY REPORT
1980 - SAILFISH
TOTAL CATCH = 29
30.
20.
-100
-90.
0 0 0 6 0 0 0 0
0 24 3 3 0 0 6 0 0 0 0
17 17 0 0 0 0 0 0 0 3
0 17 0
0

Figure 20-B

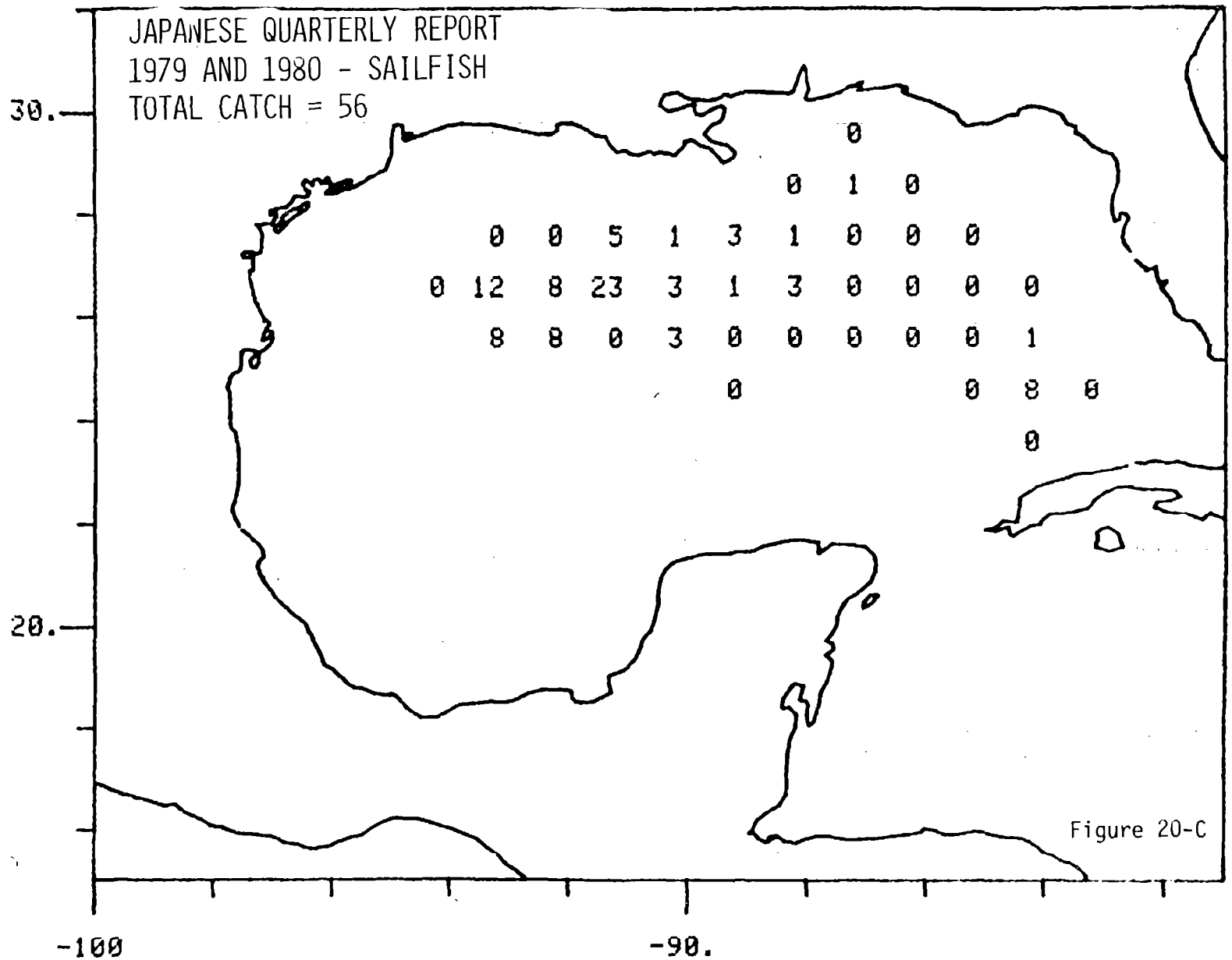

JAPANESE QUARTERLY REPORT
1979 AND 1980 - SAILFISH
TOTAL CATCH = 56
30.
20.
-100
-90.
0
0 1 0
0 0 5 1 3 1 0 0 0
0 12 8 23 3 1 3 0 0 0 0
8 8 0 3 0 0 0 0 0 1
0 0 8 0
0

Figure 20-C

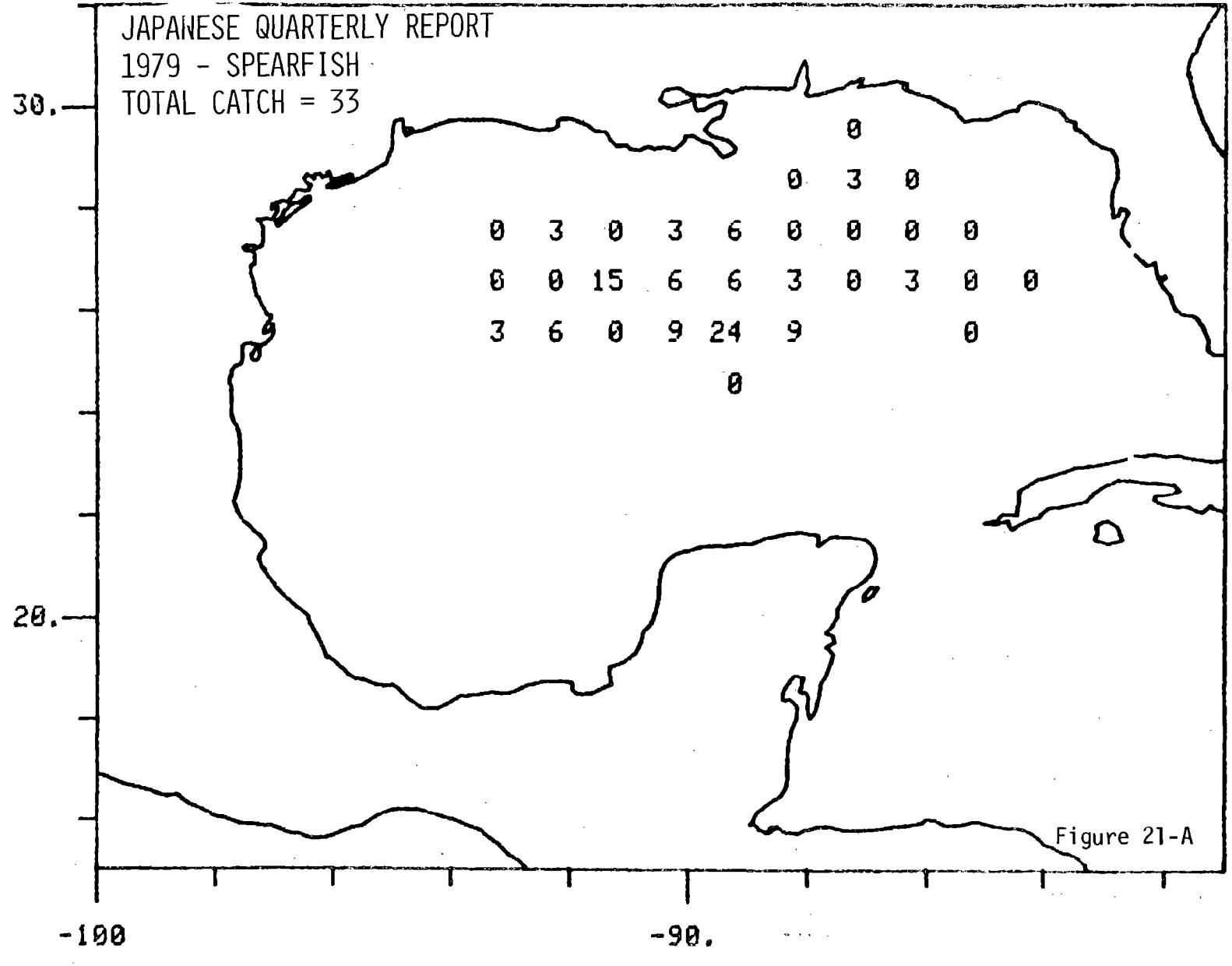

JAPANESE QUARTERLY REPORT
1979 - SPEARFISH
TOTAL CATCH = 33
30.
20.
-100
-90.
0
0 3 0
0 3 0 3 6 0 0 0 0
0 0 15 6 6 3 0 3 0 0
3 6 0 9 24 9 0
0

Figure 21-A

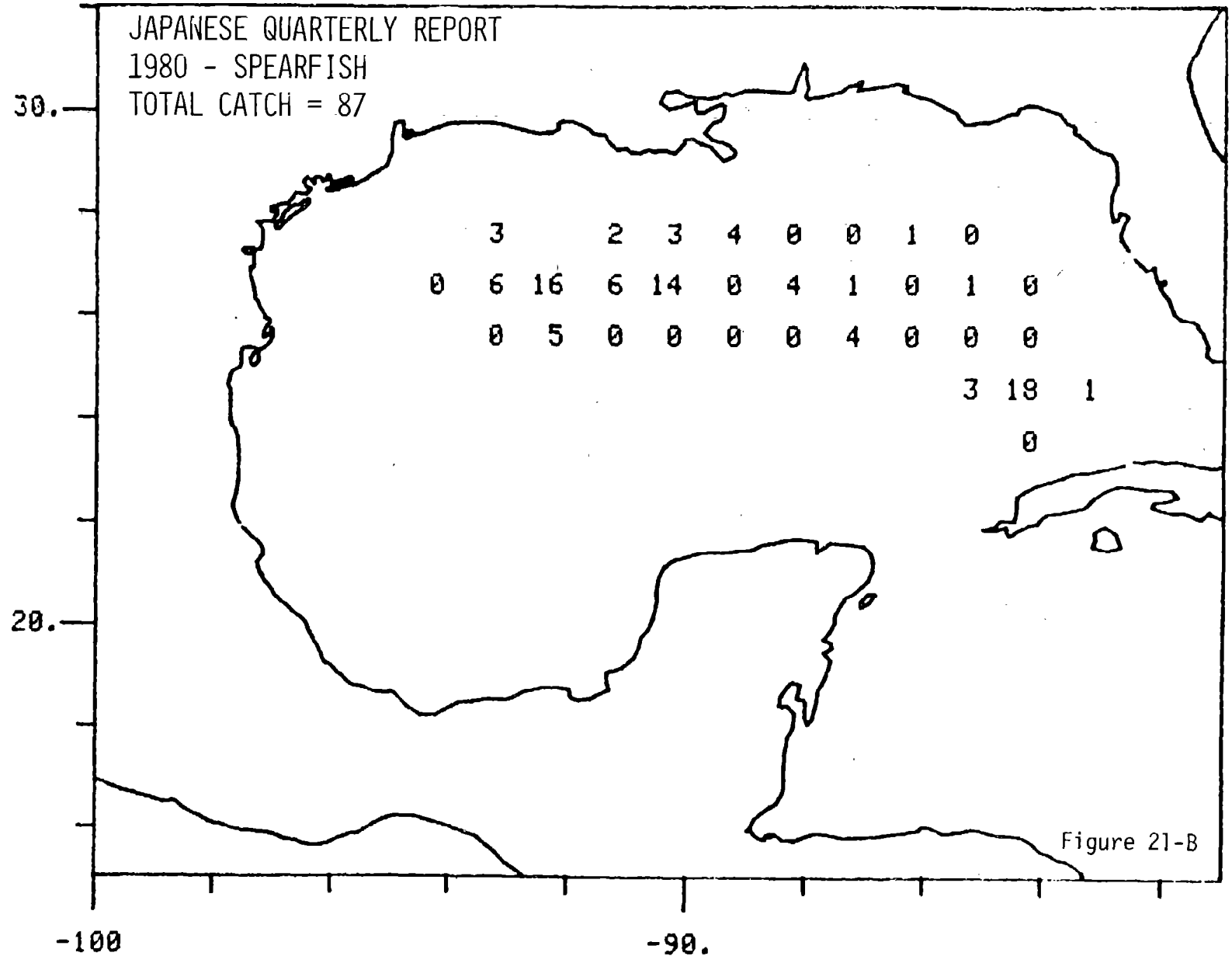

JAPANESE QUARTERLY REPORT
1980 - SPEARFISH
TOTAL CATCH = 87
30.
20.
-100
-90.
3 2 3 4 0 0 1 0
0 6 16 6 14 0 4 1 0 1 0
0 5 0 0 0 0 4 0 0 0
3 18 1
0

Figure 21-B

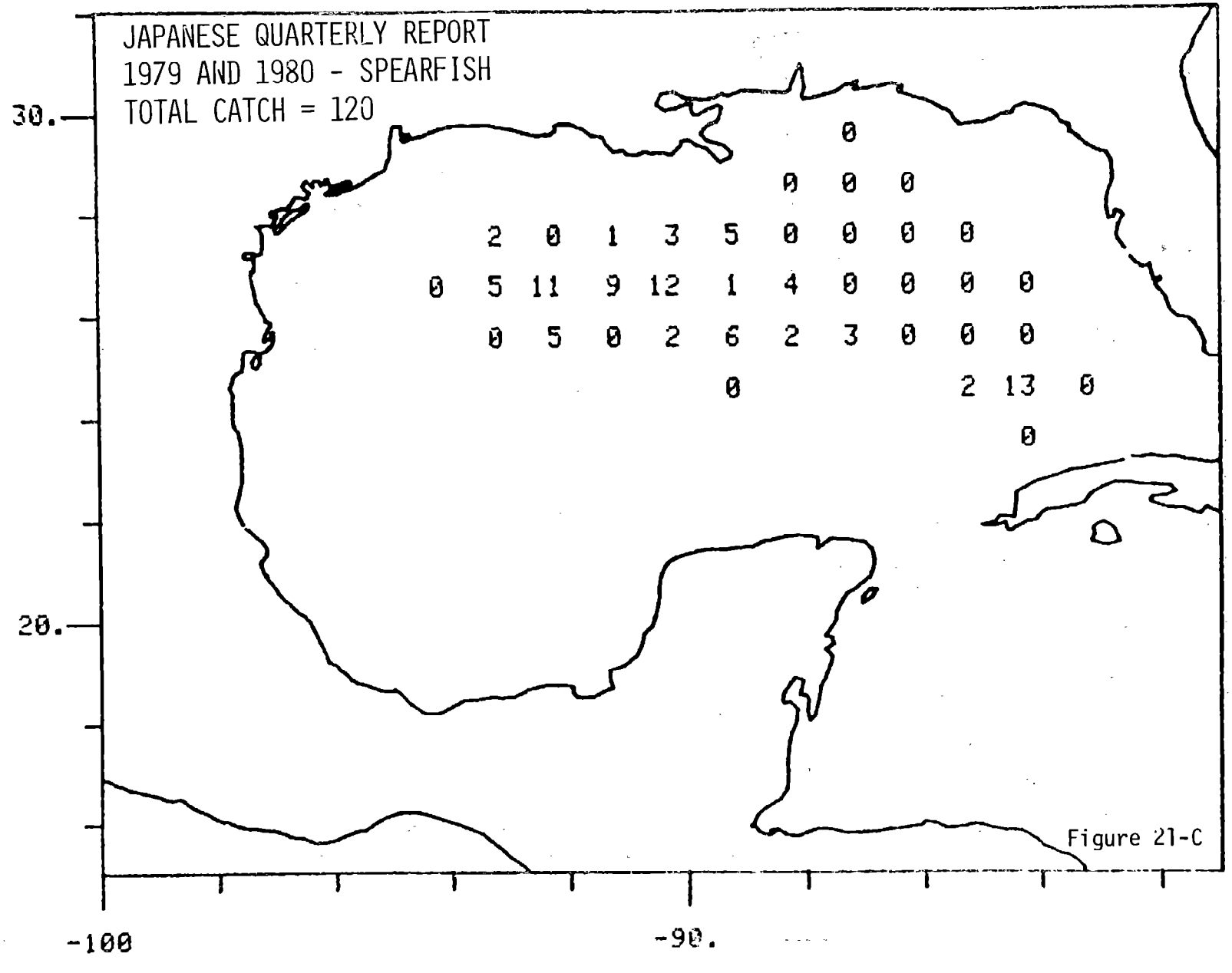

JAPANESE QUARTERLY REPORT
1979 AND 1980 - SPEARFISH
TOTAL CATCH = 120
30.
20.
-100
-90.
0
0 0 0
2 0 1 3 5 0 0 0 0
0 5 11 9 12 1 4 0 0 0 0
0 5 0 2 6 2 3 0 0 0
0 2 13 0
0

Figure 21-C

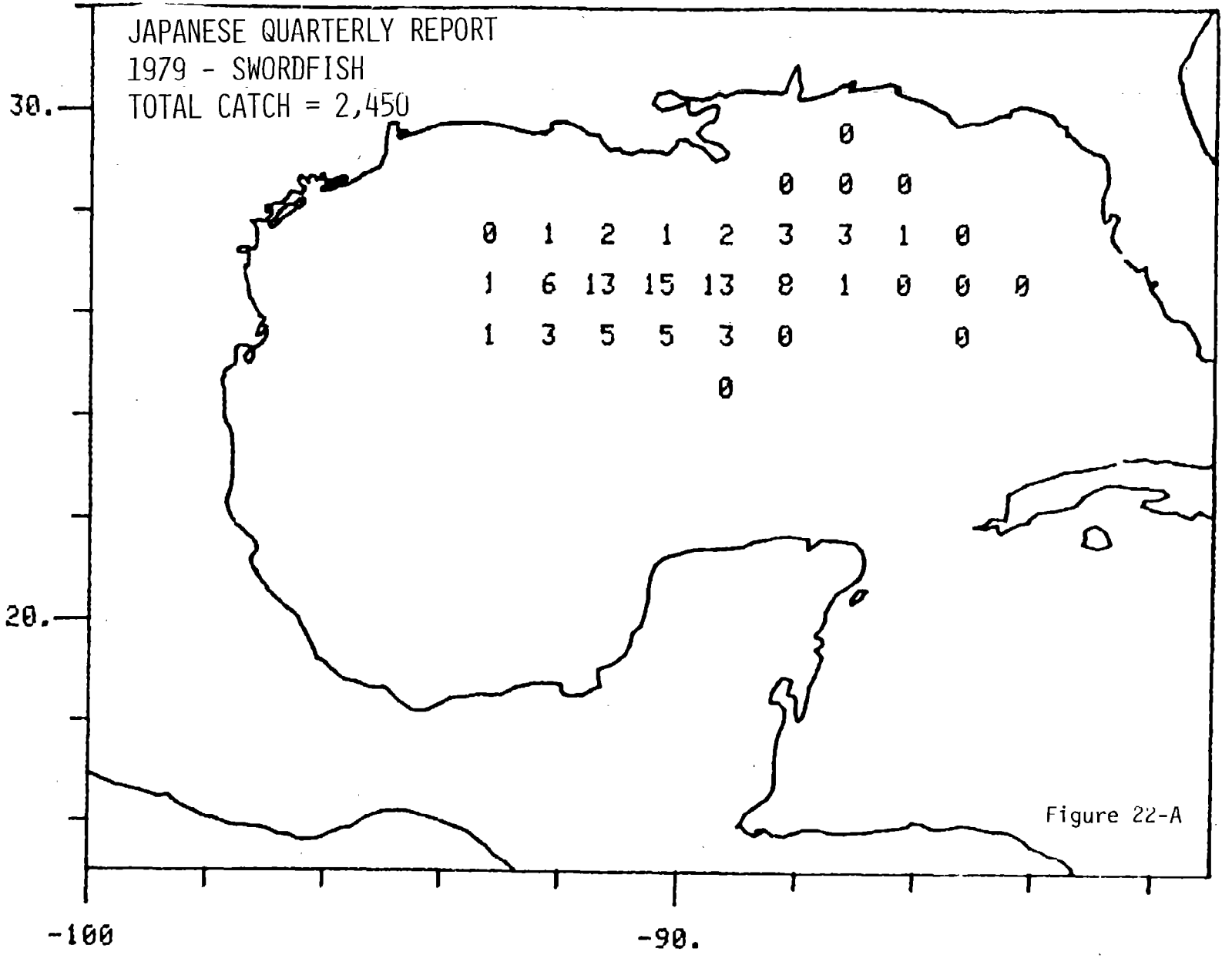

JAPANESE QUARTERLY REPORT
1979 - SWORDFISH
TOTAL CATCH = 2,450
30.
20.
-100
-90.
0
0 0 0
0 1 2 1 2 3 3 1 0
1 6 13 15 13 8 1 0 0 0
1 3 5 5 3 0 0
0

Figure 22-A

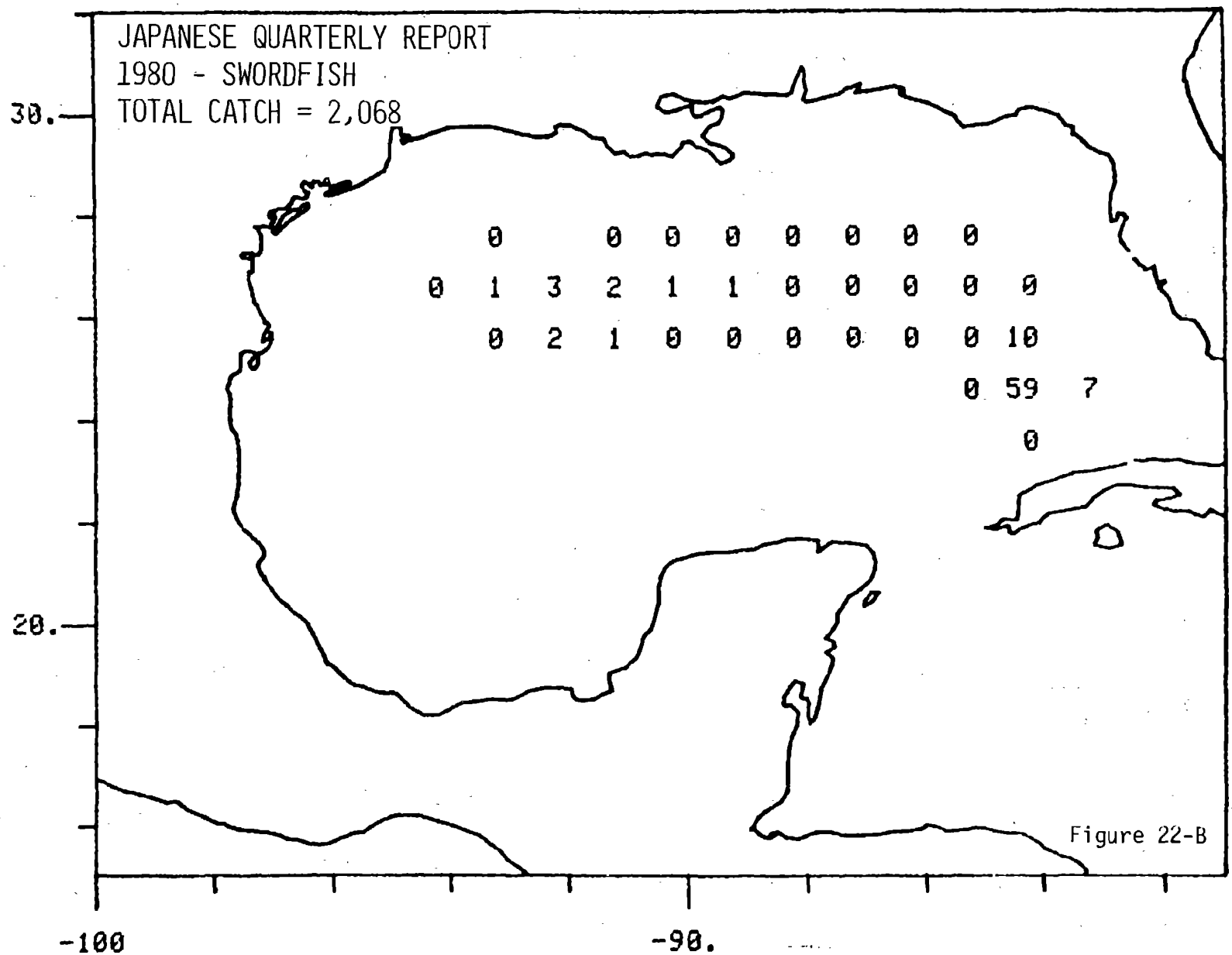

JAPANESE QUARTERLY REPORT
1980 - SWORDFISH
TOTAL CATCH = 2,068
30.
20.
-100
-90.
0 0 0 0 0 0 0 0
0 1 3 2 1 1 0 0 0 0 0
0 2 1 0 0 0 0 0 0 10
0 59 7
0

Figure 22-B

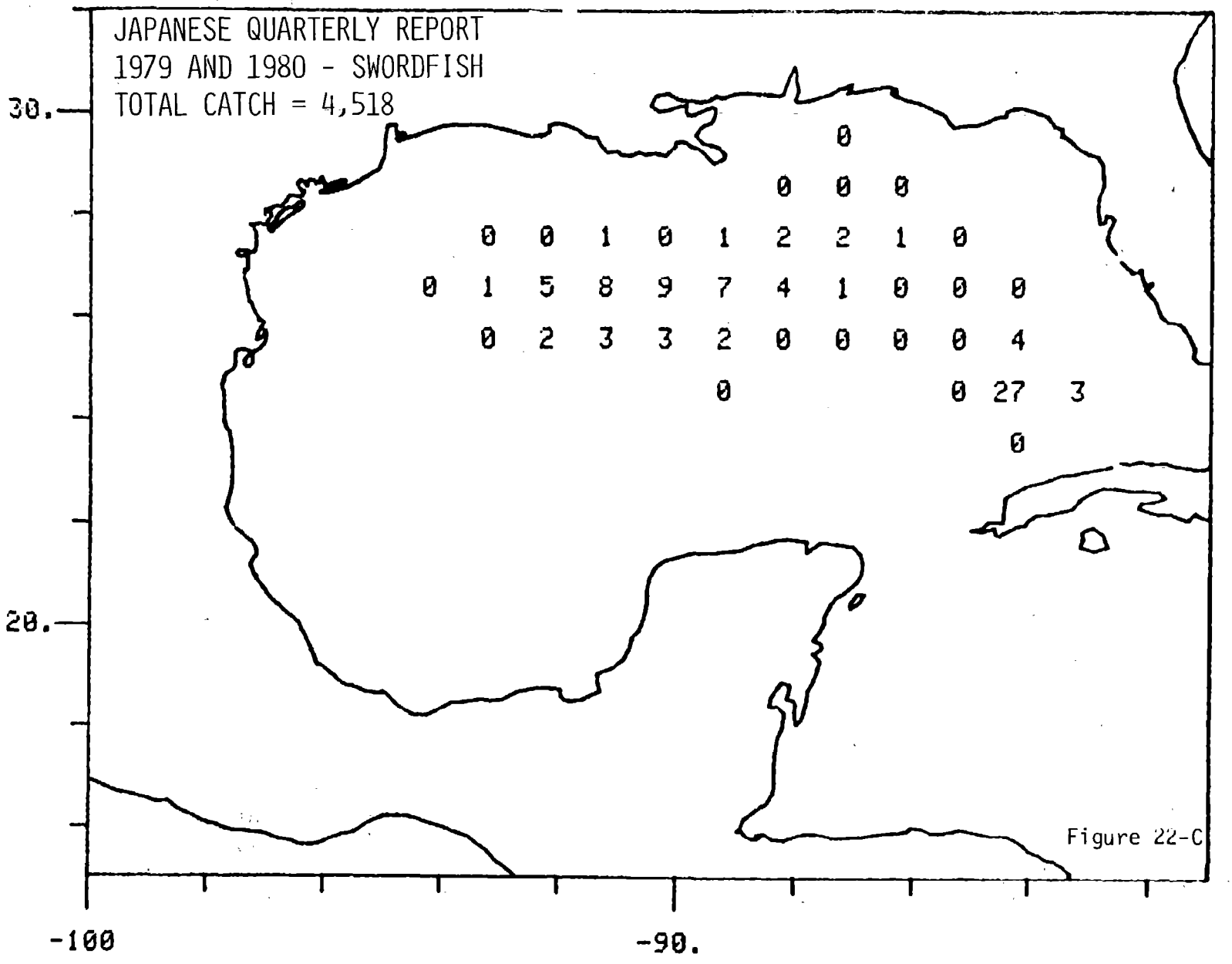

JAPANESE QUARTERLY REPORT
1979 AND 1980 - SWORDFISH
TOTAL CATCH = 4,518
30.
20.
-100
-90.
0
0 0 0
0 0 1 0 1 2 2 1 0
0 1 5 8 9 7 4 1 0 0 0
0 2 3 3 2 0 0 0 0 4
0 0 27 3
0

Figure 22-C

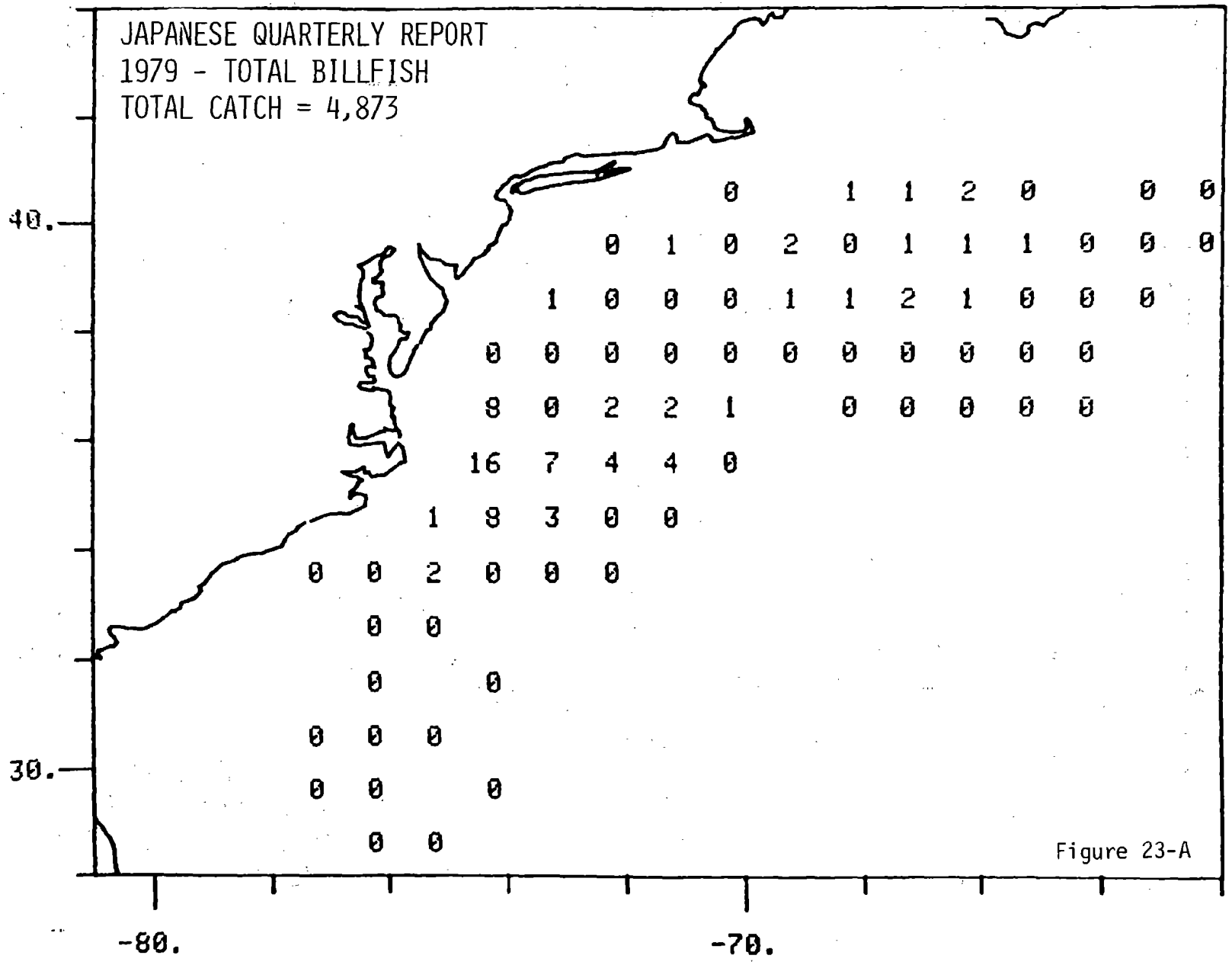

JAPANESE QUARTERLY REPORT
1979 - TOTAL BILLFISH
TOTAL CATCH = 4,873
40.
30.
-80.
-70.

Figure 23-A

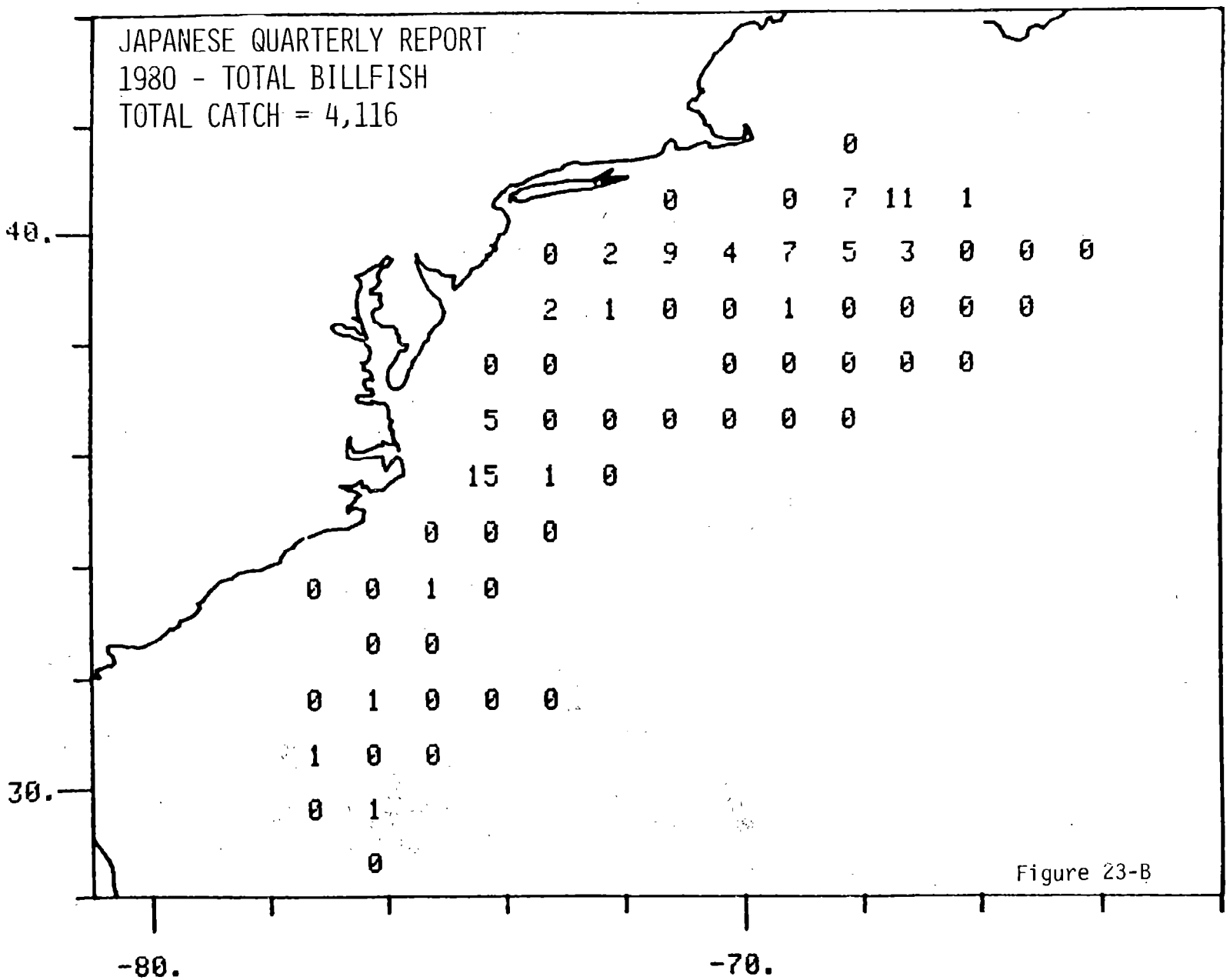

JAPANESE QUARTERLY REPORT
1980 - TOTAL BILLFISH
TOTAL CATCH = 4,116
40.
30.
-80.
-70.
0
0 0 7 11 1
0 2 9 4 7 5 3 0 0 0
2 1 0 0 1 0 0 0 0
0 0 0 0 0 0 0
5 0 0 0 0 0 0
15 1 0
0 0 0
0 0 1 0
0 0
0 1 0 0 0
1 0 0
0 1
0

Figure 23-B

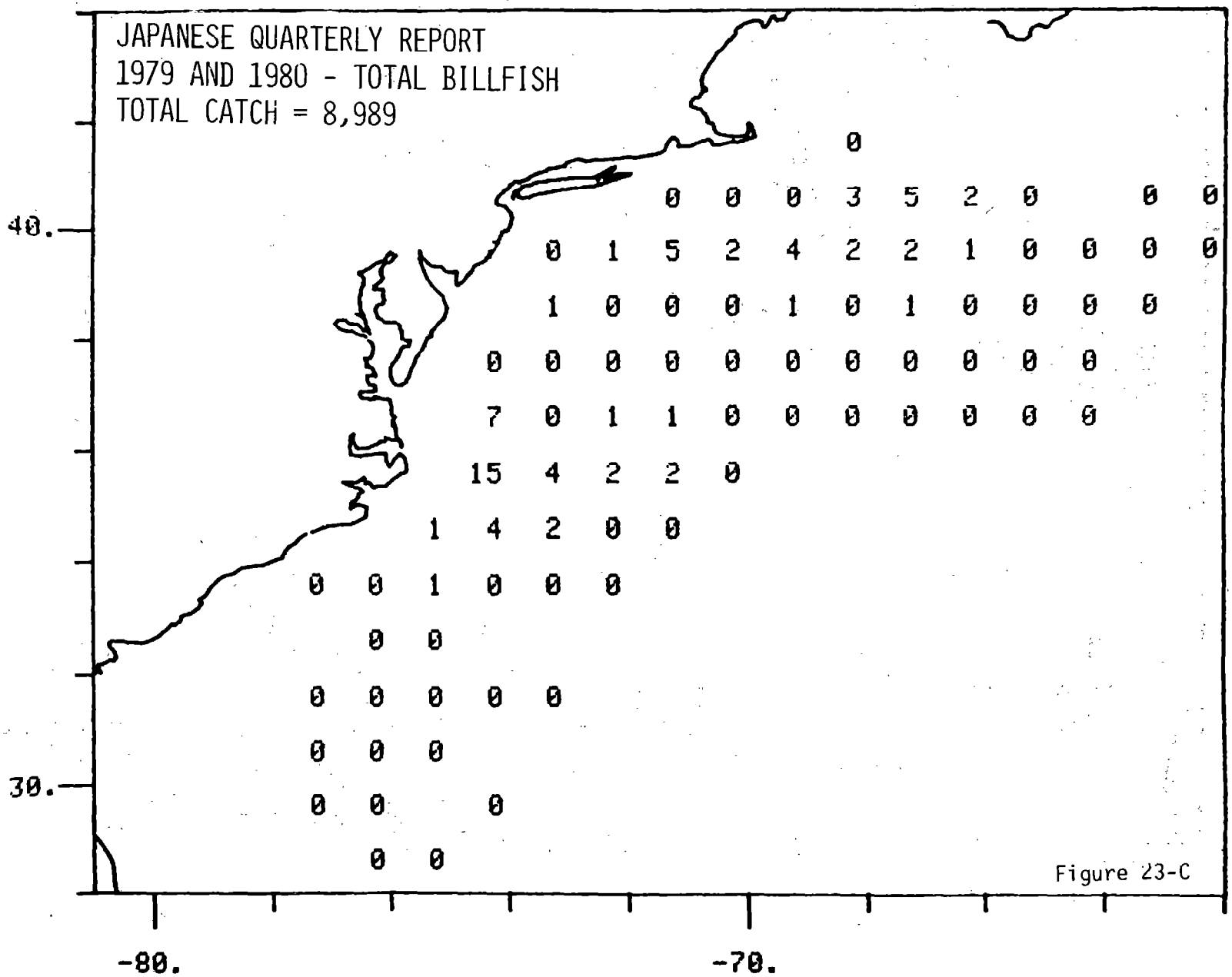

JAPANESE QUARTERLY REPORT
1979 AND 1980 - TOTAL BILLFISH
TOTAL CATCH = 8,989
40.
30.
-80.
-70.
0
0 0 0 3 5 2 0 0 0
0 1 5 2 4 2 2 1 0 0 0 0
1 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
7 0 1 1 0 0 0 0 0 0 0
15 4 2 2 0
1 4 2 0 0
0 0 1 0 0 0
0 0
0 0 0 0 0
0 0 0
0 0 0
0 0

Figure 23-C

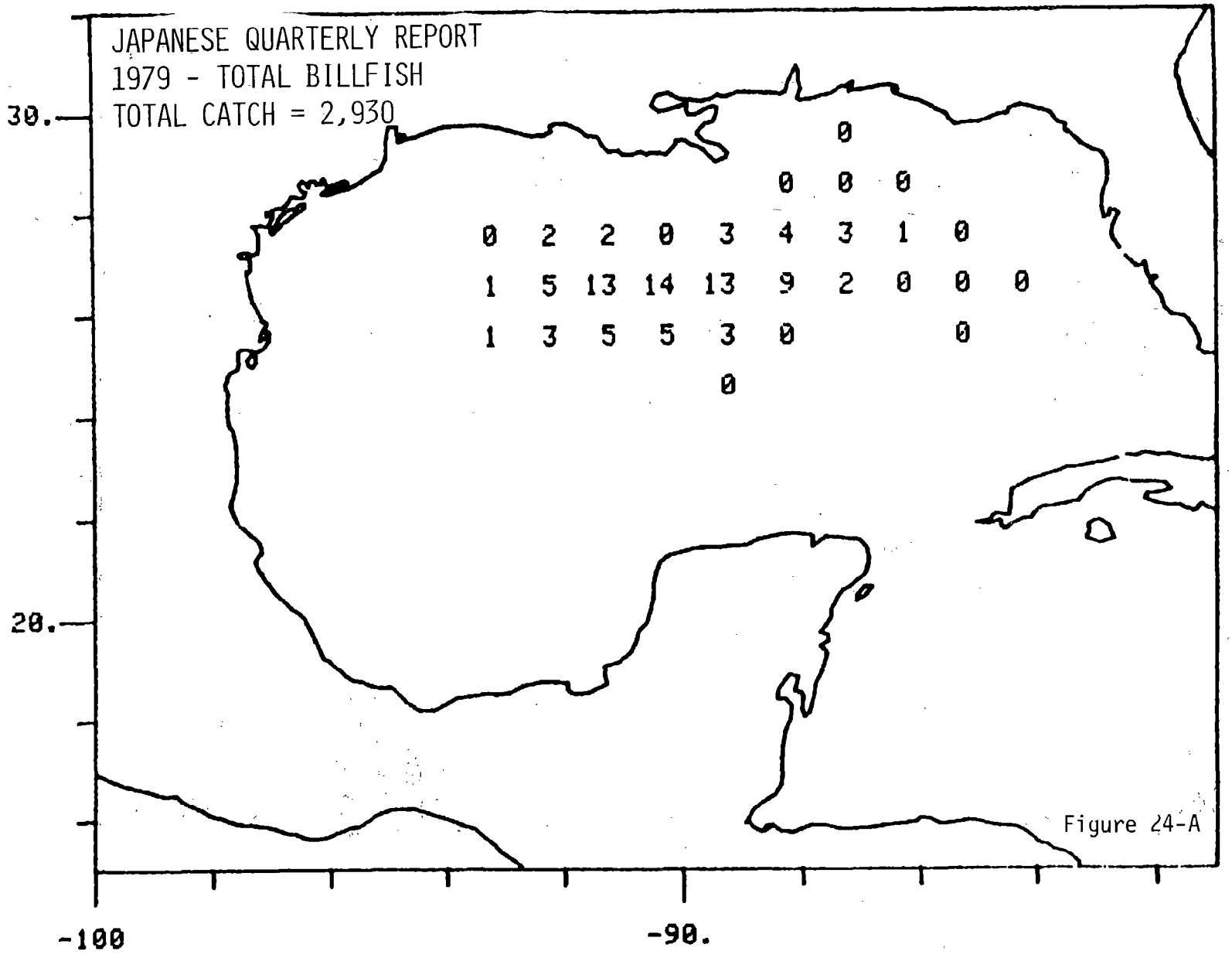

JAPANESE QUARTERLY REPORT
1979 - TOTAL BILLFISH
TOTAL CATCH = 2,930
30.
20.
-100
-90.
0
0 0 0
0 2 2 0 3 4 3 1 0
1 5 13 14 13 9 2 0 0 0
1 3 5 5 3 0 0
0

Figure 24-A

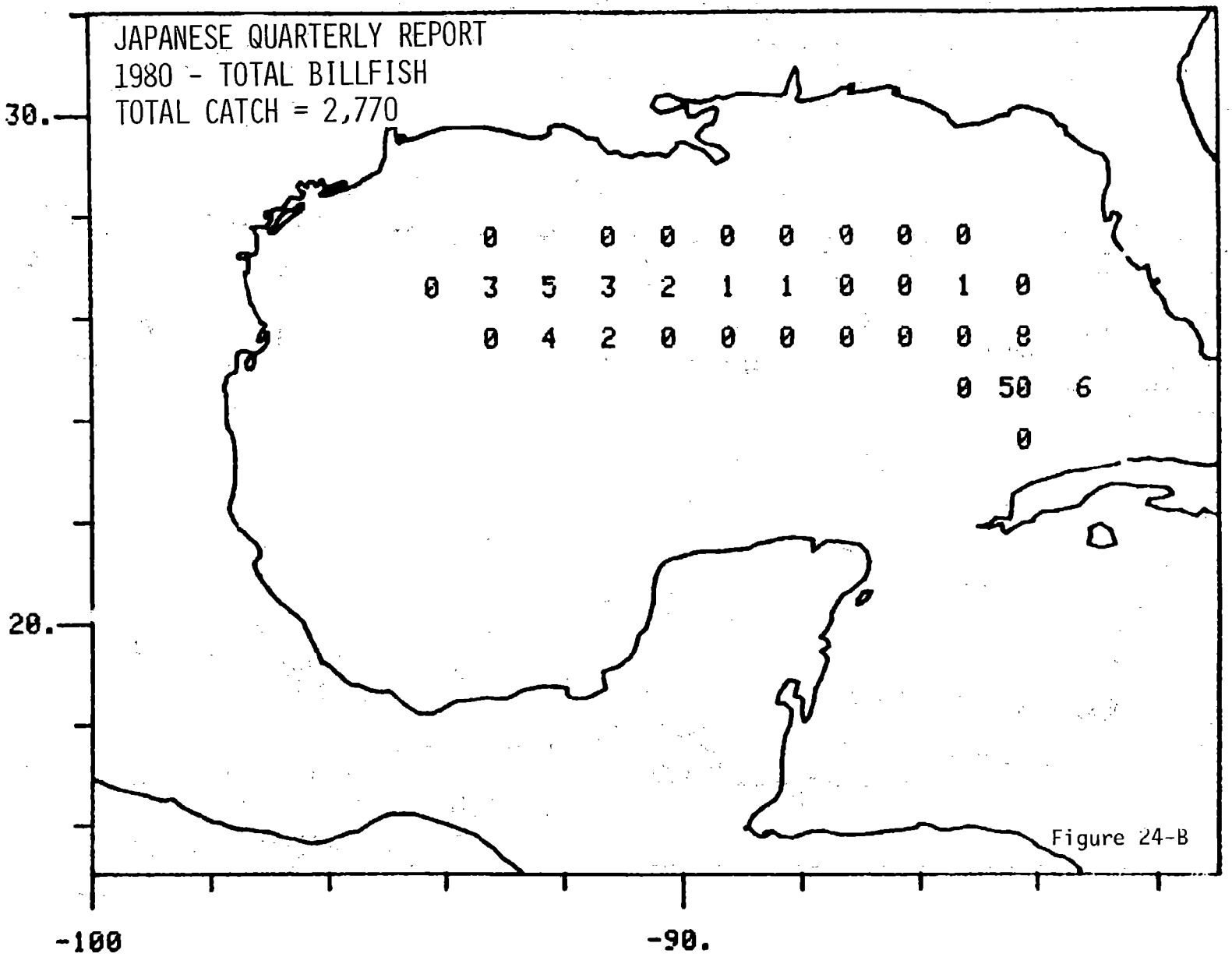

JAPANESE QUARTERLY REPORT
1980 - TOTAL BILLFISH
TOTAL CATCH = 2,770
30.
20.
-100
-90.
0 0 0 0 0 0 0 0
0 3 5 3 2 1 1 0 0 1 0
0 4 2 0 0 0 0 0 0 8
0 50 6
0

Figure 24-B

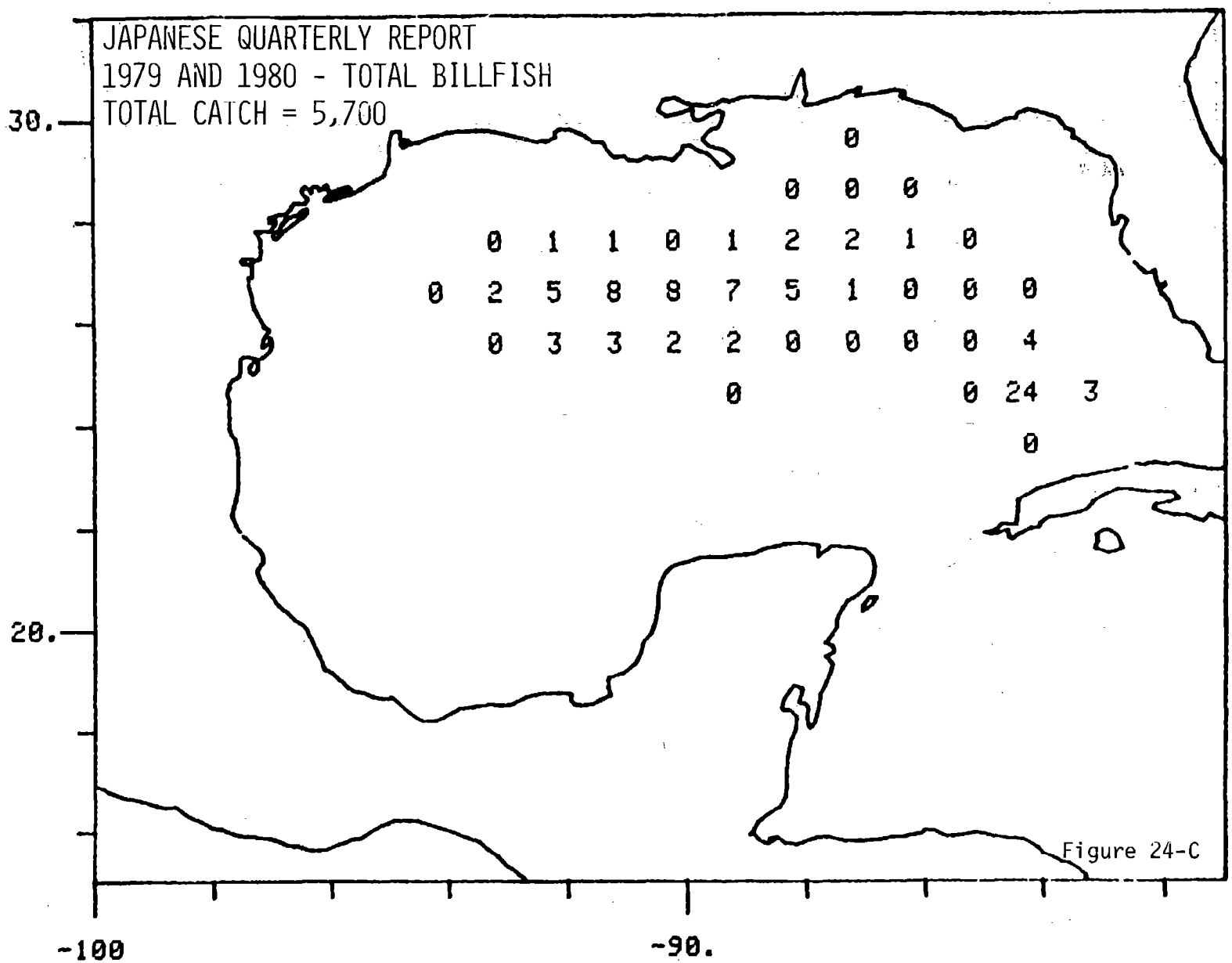

JAPANESE QUARTERLY REPORT
1979 AND 1980 - TOTAL BILLFISH
TOTAL CATCH = 5,700
30.
20.
-100
-90.
0
0 0 0
0 1 1 0 1 2 2 1 0
0 2 5 8 8 7 5 1 0 0 0
0 3 3 2 2 0 0 0 0 4
0 0 24 3
0

Figure 24-C